ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/384246692

Asp.net web application framework

Research Proposal · September 2024

DOI: 10.13140/RG.2.2.33074.62407

CITATIONS
0

READS
686

1 author:

Kamal Acharya
Tribhuvan University
249 PUBLICATIONS **4,439** CITATIONS

SEE PROFILE

All content following this page was uploaded by Kamal Acharya on 23 September 2024.

The user has requested enhancement of the downloaded file.

ASP.NET - Introduction

ASP.NET is a web application framework developed and marketed by Microsoft to allow programmers to build dynamic web sites.

It allows you to use a full featured programming language such as C# or VB.NET to build web applications easily.

ASP.NET is a web development platform, which provides a programming model, acomprehensive software infrastructure and various services required to build up robust web applications for PC, as well as mobile devices.

ASP.NET works on top of the HTTP protocol, and uses the HTTP commands and policies to set a browser-to-server bilateral communication and cooperation.

ASP.NET is a part of Microsoft .Net platform. ASP.NET applications are compiled codes, written using the extensible and reusable components or objects present in .Net framework.These codes can use the entire hierarchy of classes in .Net framework.

The ASP.NET application codes can be written in any of the following languages:

- C#
- Visual Basic.Net
- Jscript
- J#

ASP.NET is used to produce interactive, data-driven web applications over the internet. It consists of a large number of controls such as text boxes, buttons, and labels for assembling, configuring, and manipulating code to create HTML pages.

ASP.NET Web Forms Model

ASP.NET web forms extend the event-driven model of interaction to the web applications. The browser submits a web form to the web server and the server returns a full markup page or HTML page in response.

All client side user activities are forwarded to the server for stateful processing. The server processes the output of the client actions and triggers the reactions.

Now, HTTP is a stateless protocol. ASP.NET framework helps in storing the information regarding the state of the application, which consists of:

Page state

Session state

The page state is the state of the client, i.e., the content of various input fields in the web form. The session state is the collective information obtained from various pages the user visited and worked with, i.e., the overall session state. To clear the concept, let us take an example of a shopping cart.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

User adds items to a shopping cart. Items are selected from a page, say the items page, and the total collected items and price are shown on a different page, say the cart page. Only HTTP cannot keep track of all the information coming from various pages. ASP.NET session state and server side infrastructure keeps track of the information collected globally over a session.

The ASP.NET runtime carries the page state to and from the server across page requests while generating ASP.NET runtime codes, and incorporates the state of the server side components in hidden fields.

This way, the server becomes aware of the overall application state and operates in a two-tiered connected way.

The ASP.NET Component Model

The ASP.NET component model provides various building blocks of ASP.NET pages. Basically it is an object model, which describes:

Server side counterparts of almost all HTML elements or tags, such as <form> and <input>.

Server controls, which help in developing complex user-interface. For example, the Calendar control or the Gridview control.

ASP.NET is a technology, which works on the .Net framework that contains all web-related functionalities. The .Net framework is made of an object-oriented hierarchy. An ASP.NET web application is made of pages. When a user requests an ASP.NET page, the IIS delegates the processing of the page to the ASP.NET runtime system.

The ASP.NET runtime transforms the .aspx page into an instance of a class, which inherits from the base class page of the .Net framework. Therefore, each ASP.NET page is an object and all its components i.e., the server-side controls are also objects.

Components of .Net Framework

The following table describes the components of the .Net framework and the job they perform:

Components and their Description

(1) Common Language Runtime or CLR

It performs memory management, exception handling, debugging, security checking, thread execution, code execution, code safety, verification, and compilation. The code that is directly managed by the CLR is called the managed code. When the managed code is compiled, the compiler converts the source code into a CPU independent intermediate language (IL) code. A Just In Time(JIT) compiler compiles the IL code into native code, which is CPU specific.

(2) .Net Framework Class Library

It contains a huge library of reusable types. classes, interfaces, structures, and enumerated values, which are collectively called types.

(3) Common Language Specification

It contains the specifications for the .Net supported languages and implementation of language integration.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

(4) Common Type System

It provides guidelines for declaring, using, and managing types at runtime, and cross-language communication.

(5) Metadata and Assemblies

Metadata is the binary information describing the program, which is either stored in a portable executable file (PE) or in the memory. Assembly is a logical unit consisting of the assembly manifest, type metadata, IL code, and a set of resources like image files.

(6) Windows Forms

Windows Forms contain the graphical representation of any window displayed in the application.

(7) ASP.NET and ASP.NET AJAX

ASP.NET is the web development model and AJAX is an extension of ASP.NET for developing and implementing AJAX functionality. ASP.NET AJAX contains the components that allow the developer to update data on a website without a complete reload of the page.

(8) ADO.NET

It is the technology used for working with data and databases. It provides access to data sources like SQL server, OLE DB, XML etc. The ADO.NET allows connection to data sources for retrieving, manipulating, and updating data.

(9) Windows Workflow Foundation (WF)

It helps in building workflow-based applications in Windows. It contains activities, workflow runtime, workflow designer, and a rules engine.

(10) Windows Presentation Foundation

It provides a separation between the user interface and the business logic. It helps in developing visually stunning interfaces using documents, media, two and three dimensional graphics, animations, and more.

(11) Windows Communication Foundation (WCF)

It is the technology used for building and executing connected systems.

(12) Windows CardSpace

It provides safety for accessing resources and sharing personal information on the internet.

(13) LINQ

It imparts data querying capabilities to .Net languages using a syntax which is similar to the tradition query language SQL.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ASP.NET - Environment Setup

ASP.NET provides an abstraction layer on top of HTTP on which the web applications are built. It provides high-level entities such as classes and components within an object-oriented paradigm.

The key development tool for building ASP.NET applications and front ends is Visual Studio.

Visual Studio is an integrated development environment for writing, compiling, and debugging the code. It provides a complete set of development tools for building ASP.NET web applications, web services, desktop applications, and mobile applications.

Installation

Microsoft provides a free version of visual studio which also contains SQL Server and it can be downloaded from www.visualstudio.com.

Step 1 − Once downloading is complete, run the installer. The following dialog will be displayed.

Visual Studio Installer

Step 2 − Click on the Install button and it will start the installation process.

Installation Process

Step 3 − Once the installation process is completed successfully, you will see the following dialog. Close this dialog and restart your computer if required.

Setup Completed

Step 4 − Open Visual Studio from start Menu which will open the following dialog. It will be a while for the first time for preparation.

Visual Studio

Step 5 − Once all is done you will see the main window of Visual studio.

Main Window

Let’s create a new project from File → New → Project

New Project

The Visual Studio IDE

The new project window allows choosing an application template from the available templates.

Visual Studio IDE

When you start a new web site, ASP.NET provides the starting folders and files for the site, including two files for the first web form of the site.

The file named Default.aspx contains the HTML and asp code that defines the form, and the file named Default.aspx.cs (for C# coding) or the file named Default.aspx.vb (for VB coding) contains the code in the language you have chosen and this code is responsible for the actions performed on a form.

The primary window in the Visual Studio IDE is the Web Forms Designer window. Other supporting windows are the Toolbox, the Solution Explorer, and the Properties window. You use the designer to design a web form, to add code to the control on the form so that the form works according to your need, you use the code editor.

Working with Views and Windows

You can work with windows in the following ways:

To change the Web Forms Designer from one view to another, click on the Design or source button.

To close a window, click on the close button on the upper right corner and to redisplay, select it from the View menu.

To hide a window, click on its Auto Hide button. The window then changes into a tab. To display again, click the Auto Hide button again.

To change the size of a window, just drag it.

Adding Folders and Files to your Website

When a new web form is created, Visual Studio automatically generates the starting HTML for the form and displays it in Source view of the web forms designer. The Solution Explorer is used to add any other files, folders or any existing item on the web site.

To add a standard folder, right-click on the project or folder under which you are going to add the folder in the Solution Explorer and choose New Folder.

To add an ASP.NET folder, right-click on the project in the Solution Explorer and select the folder from the list.

To add an existing item to the site, right-click on the project or folder under which you are going to add the item in the Solution Explorer and select from the dialog box.

Projects and Solutions

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

A typical ASP.NET application consists of many items: the web content files (.aspx), source files (.cs files), assemblies (.dll and .exe files), data source files (.mdb files), references, icons, user controls and miscellaneous other files and folders. All these files that make up the website are contained in a Solution.

When a new website is created. VB2008 automatically creates the solution and displays it in the solution explorer.

Solutions may contain one or more projects. A project contains content files, source files, and other files like data sources and image files. Generally, the contents of a project are compiled into an assembly as an executable file (.exe) or a dynamic link library (.dll) file.

Typically a project contains the following content files:

- Page file (.aspx)
- User control (.ascx)
- Web service (.asmx)
- Master page (.master)
- Site map (.sitemap)
- Website configuration file (.config)

Building and Running a Project

You can execute an application by:

Selecting Start

Selecting Start Without Debugging from the Debug menu,

pressing F5

Ctrl-F5

The program is built meaning, the .exe or the .dll files are generated by selecting a command from the Build menu.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ASP.NET - Life Cycle

ASP.NET life cycle specifies, how:

- ASP.NET processes pages to produce dynamic output
- The application and its pages are instantiated and processed
- ASP.NET compiles the pages dynamically

The ASP.NET life cycle could be divided into two groups:

- Application Life Cycle
- Page Life Cycle

ASP.NET Application Life Cycle

The application life cycle has the following stages:

- User makes a request for accessing application resource, a page. Browser sends this request to the web server.
- A unified pipeline receives the first request and the following events take place:
    - An object of the class ApplicationManager is created.
    - An object of the class HostingEnvironment is created to provide information regarding the resources.
    - Top level items in the application are compiled.
- Response objects are created. The application objects such as HttpContext, HttpRequest and HttpResponse are created and initialized.
- An instance of the HttpApplication object is created and assigned to the request.
- The request is processed by the HttpApplication class. Different events are raised by this class for processing the request.

ASP.NET Page Life Cycle

When a page is requested, it is loaded into the server memory, processed, and sent to the browser. Then it is unloaded from the memory. At each of these steps, methods and events are available, which could be overridden according to the need of the application. In other words, you can write your own code to override the default code.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

The Page class creates a hierarchical tree of all the controls on the page. All the components on the page, except the directives, are part of this control tree. You can see the control tree by adding trace= "true" to the page directive. We will cover page directives and tracing under 'directives' and 'event handling'.

The page life cycle phases are:

- Initialization
- Instantiation of the controls on the page
- Restoration and maintenance of the state
- Execution of the event handler codes
- Page rendering

Understanding the page cycle helps in writing codes for making some specific thing happen at any stage of the page life cycle. It also helps in writing custom controls and initializing them at right time, populate their properties with view-state data and run control behavior code.

Following are the different stages of an ASP.NET page:

- **Page request** - When ASP.NET gets a page request, it decides whether to parse and compile the page, or there would be a cached version of the page; accordingly the response is sent.
- **Starting of page life cycle** - At this stage, the Request and Response objects are set. If the request is an old request or post back, the IsPostBack property of the page is set to true. The UICulture property of the page is also set.
- **Page initialization** - At this stage, the controls on the page are assigned unique ID by setting the UniqueID property and the themes are applied. For a new request, postback data is loaded and the control properties are restored to the view-state values.
- **Page load** - At this stage, control properties are set using the view state and control state values.
- **Validation** - Validate method of the validation control is called and on its successful execution, the IsValid property of the page is set to true.
- **Postback event handling** - If the request is a postback (old request), the related event handler is invoked.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

- **Page rendering** - At this stage, view state for the page and all controls are saved. The page calls the Render method for each control and the output of rendering is written to the OutputStream class of the Response property of page.
- **Unload** - The rendered page is sent to the client and page properties, such as Response and Request, are unloaded and all cleanup done.

ASP.NET Page Life Cycle Events

At each stage of the page life cycle, the page raises some events, which could be coded. An event handler is basically a function or subroutine, bound to the event, using declarative attributes such as Onclick or handle.

Following are the page life cycle events:

- **PreInit** - PreInit is the first event in page life cycle. It checks the IsPostBack property and determines whether the page is a postback. It sets the themes and master pages, creates dynamic controls, and gets and sets profile property values. This event can be handled by overloading the OnPreInit method or creating a Page_PreInit handler.
- **Init** - Init event initializes the control property and the control tree is built. This event can be handled by overloading the OnInit method or creating a Page_Init handler.
- **InitComplete** - InitComplete event allows tracking of view state. All the controls turn on view-state tracking.
- **LoadViewState** - LoadViewState event allows loading view state information into the controls.
- **LoadPostData** - During this phase, the contents of all the input fields are defined with the <form> tag are processed.
- **PreLoad** - PreLoad occurs before the post back data is loaded in the controls. This event can be handled by overloading the OnPreLoad method or creating a Page_PreLoad handler.
- **Load** - The Load event is raised for the page first and then recursively for all child controls. The controls in the control tree are created. This event can be handled by overloading the OnLoad method or creating a Page_Load handler.
- **LoadComplete** - The loading process is completed, control event handlers are run, and page validation takes place. This event can be handled by overloading the OnLoadComplete method or creating a Page_LoadComplete handler

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

- **PreRender** - The PreRender event occurs just before the output is rendered. By handling this event, pages and controls can perform any updates before the output is rendered.
- **PreRenderComplete** - As the PreRender event is recursively fired for all child controls, this event ensures the completion of the pre-rendering phase.
- **SaveStateComplete** - State of control on the page is saved. Personalization, control state and view state information is saved. The HTML markup is generated. This stage can be handled by overriding the Render method or creating a Page_Render handler.
- **UnLoad** - The UnLoad phase is the last phase of the page life cycle. It raises the UnLoad event for all controls recursively and lastly for the page itself. Final cleanup is done and all resources and references, such as database connections, are freed. This event can be handled by modifying the OnUnLoad method or creating a Page_UnLoad handler.

ASP.NET - First Example

An ASP.NET page is made up of a number of server controls along with HTML controls, text, and images. Sensitive data from the page and the states of different controls on the page are stored in hidden fields that form the context of that page request.

ASP.NET runtime controls the association between a page instance and its state. An ASP.NET page is an object of the Page or inherited from it.

All the controls on the pages are also objects of the related control class inherited from a parent Control class. When a page is run, an instance of the object page is created along with all its content controls.

An ASP.NET page is also a server side file saved with the .aspx extension. It is modular in nature and can be divided into the following core sections:

- Page Directives
- Code Section
- Page Layout

Page Directives

The page directives set up the environment for the page to run. The @Page directive defines page-specific attributes used by ASP.NET page parser and compiler. Page directives specify howthe page should be processed, and which assumptions need to be taken about the page.

It allows importing namespaces, loading assemblies, and registering new controls with custom tag names and namespace prefixes.

Code Section

The code section provides the handlers for the page and control events along with other functions required. We mentioned that, ASP.NET follows an object model. Now, these objects raise events when some events take place on the user interface, like a user clicks a button or moves the cursor. The kind of response these events need to reciprocate is coded in the event handler functions. The event handlers are nothing but functions bound to the controls.

The code section or the code behind file provides all these event handler routines, and other functions used by the developer. The page code could be precompiled and deployed in the form of a binary assembly.

Page Layout

The page layout provides the interface of the page. It contains the server controls, text, inline JavaScript, and HTML tags.

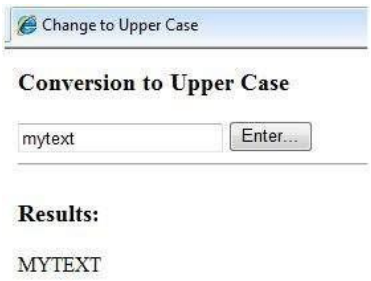
The following code snippet provides a sample ASP.NET page explaining Page directives, code section and page layout written in C#:

```
<!-- directives -->
<% @Page Language="C#" %>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
<!-- code section -->
<script runat="server">

  private void convertoupper(object sender, EventArgs e)
  {
    string str = mytext.Value;
    changed_text.InnerHtml = str.ToUpper();
  }
</script>

<!-- Layout -->
<html>
  <head>
    <title> Change to Upper Case </title>
  </head>

  <body>
    <h3> Conversion to Upper Case </h3>

    <form runat="server">
      <input runat="server" id="mytext" type="text" />
      <input runat="server" id="button1" type="submit" value="Enter..."
OnServerClick="convertoupper"/>

      <hr />
      <h3> Results: </h3>
      <span runat="server" id="changed_text" />
    </form>

  </body>

</html>
```

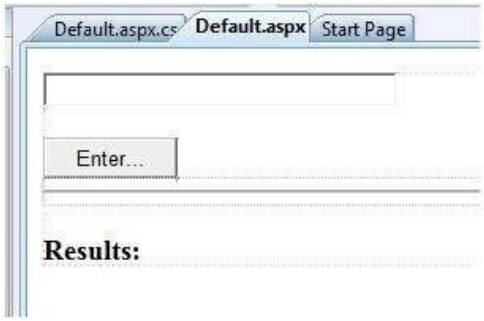
Copy this file to the web server root directory. Generally it is c:\iNETput\wwwroot. Open the file from the browser to execute it and it generates following result:



Using Visual Studio IDE

Let us develop the same example using Visual Studio IDE. Instead of typing the code, you can just drag the controls into the design view:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en



The content file is automatically developed. All you need to add is the Button1_Click routine, which is as follows:

```
protected void Button1_Click(object sender, EventArgs e)
{
  string buf = TextBox1.Text;
  changed_text.InnerHtml = buf.ToUpper();
}
```

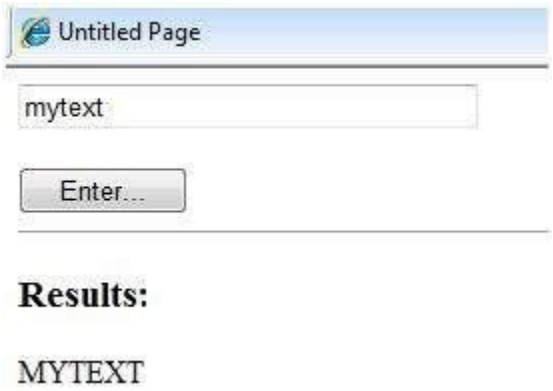
The content file code is as given:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
  Inherits="firstexample._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>
      Untitled Page
    </title>
  </head>

  <body>

    <form id="form1" runat="server">
      <div>

        <asp:TextBox ID="TextBox1" runat="server" style="width:224px">
        </asp:TextBox>

        <br />
        <br />

        <asp:Button ID="Button1" runat="server" Text="Enter..." style="width:85px"
onclick="Button1_Click" />
        <hr />
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
        <h3> Results: </h3>
        <span runat="server" id="changed_text" />

      </div>
    </form>

  </body>

</html>
```

Execute the example by right clicking on the design view and choosing 'View in Browser' from the popup menu. This generates the following result:



ASP.NET - Event Handling

An event is an action or occurrence such as a mouse click, a key press, mouse movements, or any system-generated notification. A process communicates through events. For example, interrupts are system-generated events. When events occur, the application should be able to respond to it and manage it.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Events in ASP.NET raised at the client machine, and handled at the server machine. Forexample, a user clicks a button displayed in the browser. A Click event is raised. The browser handles this client-side event by posting it to the server.

The server has a subroutine describing what to do when the event is raised; it is called the event-handler. Therefore, when the event message is transmitted to the server, it checks whether the Click event has an associated event handler. If it has, the event handler is executed.

Event Arguments

ASP.NET event handlers generally take two parameters and return void. The first parameter represents the object raising the event and the second parameter is event argument.

The general syntax of an event is:

```
private void EventName (object sender, EventArgs e);
```

Application and Session Events

The most important application events are:

- **Application_Start** - It is raised when the application/website is started.
- **Application_End** - It is raised when the application/website is stopped.

Similarly, the most used Session events are:

- **Session_Start** - It is raised when a user first requests a page from the application.
- **Session_End** - It is raised when the session ends.

Page and Control Events

Common page and control events are:

- **DataBinding** - It is raised when a control binds to a data source.
- **Disposed** - It is raised when the page or the control is released.
- **Error** - It is a page event, occurs when an unhandled exception is thrown.
- **Init** - It is raised when the page or the control is initialized.
- **Load** - It is raised when the page or a control is loaded.
- **PreRender** - It is raised when the page or the control is to be rendered.
- **Unload** - It is raised when the page or control is unloaded from memory.

Event Handling Using Controls

All ASP.NET controls are implemented as classes, and they have events which are fired when a user performs a certain action on them. For example, when a user clicks a button the 'Click' event is generated. For handling events, there are in-built attributes and event handlers. Event handler is coded to respond to an event, and take appropriate action on it.

By default, Visual Studio creates an event handler by including a Handles clause on the Sub procedure. This clause names the control and event that the procedure handles.

The ASP tag for a button control:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
<asp:Button ID="btnCancel" runat="server" Text="Cancel" />
```

The event handler for the Click event:

```
Protected Sub btnCancel_Click(ByVal sender As Object, ByVal e As System.EventArgs)

  Handles btnCancel.Click

End Sub
```

An event can also be coded without Handles clause. Then, the handler must be named according to the appropriate event attribute of the control.

The ASP tag for a button control:

```
<asp:Button ID="btnCancel" runat="server" Text="Cancel" Onclick="btnCancel_Click" />
```

The event handler for the Click event:

```
Protected Sub btnCancel_Click(ByVal sender As Object, ByVal e As System.EventArgs)

End Sub
```

The common control events are:

Event	Attribute	Controls
Click	OnClick	Button, image button, link button, image map
Command	OnCommand	Button, image button, link button
TextChanged	OnTextChanged	Text box
SelectedIndexChanged	OnSelectedIndexChanged	Drop-down list, list box, radio button list, check box list.
CheckedChanged	OnCheckedChanged	Check box, radio button

Some events cause the form to be posted back to the server immediately, these are called the postback events. For example, the click event such as, Button.Click.

Some events are not posted back to the server immediately, these are called non-postback events.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

For example, the change events or selection events such as TextBox.TextChanged or CheckBox.CheckedChanged. The nonpostback events could be made to post back immediately by setting their AutoPostBack property to true.

Default Events

The default event for the Page object is Load event. Similarly, every control has a default event. For example, default event for the button control is the Click event.

The default event handler could be created in Visual Studio, just by double clicking the control in design view. The following table shows some of the default events for common controls:

Control	Default Event
AdRotator	AdCreated
BulletedList	Click
Button	Click
Calender	SelectionChanged
CheckBox	CheckedChanged
CheckBoxList	SelectedIndexChanged
DataGrid	SelectedIndexChanged
DataList	SelectedIndexChanged
DropDownList	SelectedIndexChanged
HyperLink	Click
ImageButton	Click
ImageMap	Click

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

LinkButton	Click
ListBox	SelectedIndexChanged
Menu	MenuItemClick
RadioButton	CheckedChanged
RadioButtonList	SelectedIndexChanged

Example

This example includes a simple page with a label control and a button control on it. As the page events such as Page_Load, Page_Init, Page_PreRender etc. take place, it sends a message, which is displayed by the label control. When the button is clicked, the Button_Click event is raised and that also sends a message to be displayed on the label.

Create a new website and drag a label control and a button control on it from the control tool box. Using the properties window, set the IDs of the controls as .lblmessage. and .btnclick. respectively. Set the Text property of the Button control as 'Click'.

The markup file (.aspx):

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
  Inherits="eventdemo._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>Untitled Page</title>
  </head>

  <body>
    <form id="form1" runat="server">
      <div>
        <asp:Label ID="lblmessage" runat="server" >

        </asp:Label>

        <br />
        <br />
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

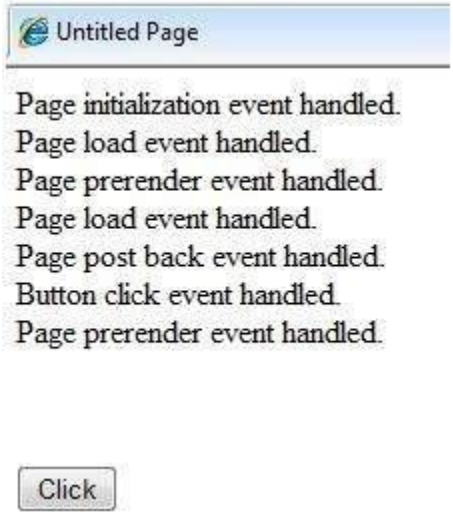
```
        <br />

        <asp:Button ID="btnclick" runat="server" Text="Click" onclick="btnclick_Click" />
      </div>
    </form>
  </body>

</html>
```

Double click on the design view to move to the code behind file. The Page_Load event is automatically created without any code in it. Write down the following self-explanatory code lines:

```
using System;
using System.Collections;
using System.Configuration;
using System.Data;
using System.Linq;

using System.Web;
using System.Web.Security;
using System.Web.UI;
using System.Web.UI.HtmlControls;
using System.Web.UI.WebControls;
using System.Web.UI.WebControls.WebParts;

using System.Xml.Linq;

namespace eventdemo {

  public partial class _Default : System.Web.UI.Page {

    protected void Page_Load(object sender, EventArgs e) {
      lblmessage.Text += "Page load event handled. <br />";

      if (Page.IsPostBack) {
        lblmessage.Text += "Page post back event handled.<br/>";
      }
    }

    protected void Page_Init(object sender, EventArgs e) {
      lblmessage.Text += "Page initialization event handled.<br/>";
    }

    protected void Page_PreRender(object sender, EventArgs e) {
      lblmessage.Text += "Page prerender event handled. <br/>";
    }
```

```
    protected void btnclick_Click(object sender, EventArgs e) {
      lblmessage.Text += "Button click event handled. <br/>";
    }
  }
}
```

Execute the page. The label shows page load, page initialization and, the page pre-render events. Click the button to see effect:



ASP.NET - Server Side

We have studied the page life cycle and how a page contains various controls. The page itself is instantiated as a control object. All web forms are basically instances of the ASP.NET Page class. The page class has the following extremely useful properties that correspond to intrinsic objects:

- Session
- Application
- Cache

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

- Request
- Response
- Server
- User
- Trace

We will discuss each of these objects in due time. In this tutorial we will explore the Server object, the Request object, and the Response object.

Server Object

The Server object in Asp.NET is an instance of the System.Web.HttpServerUtility class. The HttpServerUtility class provides numerous properties and methods to perform various jobs.

Properties and Methods of the Server object

The methods and properties of the HttpServerUtility class are exposed through the intrinsic Server object provided by ASP.NET.

The following table provides a list of the properties:

Property	Description
MachineName	Name of server computer
ScriptTimeOut	Gets and sets the request time-out value in seconds.

The following table provides a list of some important methods:

Method	Description
CreateObject(String)	Creates an instance of the COM object identified by its ProgID (Programmatic ID).
CreateObject(Type)	Creates an instance of the COM object identified by its Type.
Equals(Object)	Determines whether the specified Object is equal to the current Object.
Execute(String)	Executes the handler for the specified virtual path in

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	the context of the current request.
Execute(String, Boolean)	Executes the handler for the specified virtual path in the context of the current request and specifies whether to clear the QueryString and Form collections.
GetLastError	Returns the previous exception.
GetType	Gets the Type of the current instance.
HtmlEncode	Changes an ordinary string into a string with legal HTML characters.
HtmlDecode	Converts an Html string into an ordinary string.
ToString	Returns a String that represents the current Object.
Transfer(String)	For the current request, terminates execution of the current page and starts execution of a new page by using the specified URL path of the page.
UrlDecode	Converts an URL string into an ordinary string.
UrlEncodeToken	Works same as UrlEncode, but on a byte array that contains Base64-encoded data.
UrlDecodeToken	Works same as UrlDecode, but on a byte array that contains Base64-encoded data.
MapPath	Return the physical path that corresponds to a specified virtual file path on the server.
Transfer	Transfers execution to another web page in the

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	current application.

Request Object

The request object is an instance of the System.Web.HttpRequest class. It represents the values and properties of the HTTP request that makes the page loading into the browser.

The information presented by this object is wrapped by the higher level abstractions (the web control model). However, this object helps in checking some information such as the client browser and cookies.

Properties and Methods of the Request Object

The following table provides some noteworthy properties of the Request object:

Property	Description
AcceptTypes	Gets a string array of client-supported MIME accept types.
ApplicationPath	Gets the ASP.NET application's virtual application root path on the server.
Browser	Gets or sets information about the requesting client's browser capabilities.
ContentEncoding	Gets or sets the character set of the entity-body.
ContentLength	Specifies the length, in bytes, of content sent by the client.
ContentType	Gets or sets the MIME content type of the incoming request.
Cookies	Gets a collection of cookies sent by the client.
FilePath	Gets the virtual path of the current request.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Files	Gets the collection of files uploaded by the client, in multipart MIME format.
Form	Gets a collection of form variables.
Headers	Gets a collection of HTTP headers.
HttpMethod	Gets the HTTP data transfer method (such as GET, POST, or HEAD) used by the client.
InputStream	Gets the contents of the incoming HTTP entity body.
IsSecureConnection	Gets a value indicating whether the HTTP connection uses secure sockets (that is, HTTPS).
QueryString	Gets the collection of HTTP query string variables.
RawUrl	Gets the raw URL of the current request.
RequestType	Gets or sets the HTTP data transfer method (GET or POST) used by the client.
ServerVariables	Gets a collection of Web server variables.
TotalBytes	Gets the number of bytes in the current input stream.
Url	Gets information about the URL of the current request.
UrlReferrer	Gets information about the URL of the client's previous request that is linked to the current URL.

UserAgent	Gets the raw user agent string of the client browser.
UserHostAddress	Gets the IP host address of the remote client.
UserHostName	Gets the DNS name of the remote client.
UserLanguages	Gets a sorted string array of client language preferences.

The following table provides a list of some important methods:

Method	Description
BinaryRead	Performs a binary read of a specified number of bytes from the current input stream.
Equals(Object)	Determines whether the specified object is equal to the current object. (Inherited from object.)
GetType	Gets the Type of the current instance.
MapImageCoordinates	Maps an incoming image-field form parameter to appropriate x-coordinate and y-coordinate values.
MapPath(String)	Maps the specified virtual path to a physical path.
SaveAs	Saves an HTTP request to disk.
ToString	Returns a String that represents the current object.
ValidateInput	Causes validation to occur for the collections accessed through the Cookies, Form, and QueryString properties.

Response Object

The Response object represents the server's response to the client request. It is an instance of the System.Web.HttpResponse class.

In ASP.NET, the response object does not play any vital role in sending HTML text to the client, because the server-side controls have nested, object oriented methods for rendering themselves.

However, the HttpResponse object still provides some important functionalities, like the cookie feature and the Redirect() method. The Response.Redirect() method allows transferring the user to another page, inside as well as outside the application. It requires a round trip.

Properties and Methods of the Response Object

The following table provides some noteworthy properties of the Response object:

Property	Description
Buffer	Gets or sets a value indicating whether to buffer the output and send it after the complete response is finished processing.
BufferOutput	Gets or sets a value indicating whether to buffer the output and send it after the complete page is finished processing.
Charset	Gets or sets the HTTP character set of the output stream.
ContentEncoding	Gets or sets the HTTP character set of the output stream.
ContentType	Gets or sets the HTTP MIME type of the output stream.
Cookies	Gets the response cookie collection.
Expires	Gets or sets the number of minutes before a page cached on a browser expires.
ExpiresAbsolute	Gets or sets the absolute date and time at which to

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	remove cached information from the cache.
HeaderEncoding	Gets or sets an encoding object that represents the encoding for the current header output stream.
Headers	Gets the collection of response headers.
IsClientConnected	Gets a value indicating whether the client is still connected to the server.
Output	Enables output of text to the outgoing HTTP response stream.
OutputStream	Enables binary output to the outgoing HTTP content body.
RedirectLocation	Gets or sets the value of the Http Location header.
Status	Sets the status line that is returned to the client.
StatusCode	Gets or sets the HTTP status code of the output returned to the client.
StatusDescription	Gets or sets the HTTP status string of the output returned to the client.
SubStatusCode	Gets or sets a value qualifying the status code of the response.
SuppressContent	Gets or sets a value indicating whether to send HTTP content to the client.

The following table provides a list of some important methods:

Method	Description

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

AddHeader	Adds an HTTP header to the output stream. AddHeader is provided for compatibility with earlier versions of ASP.
AppendCookie	Infrastructure adds an HTTP cookie to the intrinsic cookie collection.
AppendHeader	Adds an HTTP header to the output stream.
AppendToLog	Adds custom log information to the InterNET Information Services (IIS) log file.
BinaryWrite	Writes a string of binary characters to the HTTP output stream.
ClearContent	Clears all content output from the buffer stream.
Close	Closes the socket connection to a client.
End	Sends all currently buffered output to the client, stops execution of the page, and raises the EndRequest event.
Equals(Object)	Determines whether the specified object is equal to the current object.
Flush	Sends all currently buffered output to the client.
GetType	Gets the Type of the current instance.
Pics	Appends a HTTP PICS-Label header to the output stream.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Redirect(String)	Redirects a request to a new URL and specifies the new URL.
Redirect(String, Boolean)	Redirects a client to a new URL. Specifies the new URL and whether execution of the current page should terminate.
SetCookie	Updates an existing cookie in the cookie collection.
ToString	Returns a String that represents the current Object.
TransmitFile(String)	Writes the specified file directly to an HTTP response output stream, without buffering it in memory.
Write(Char)	Writes a character to an HTTP response output stream.
Write(Object)	Writes an object to an HTTP response stream.
Write(String)	Writes a string to an HTTP response output stream.
WriteFile(String)	Writes the contents of the specified file directly to an HTTP response output stream as a file block.
WriteFile(String, Boolean)	Writes the contents of the specified file directly to an HTTP response output stream as a memory block.

Example

The following simple example has a text box control where the user can enter name, a button to send the information to the server, and a label control to display the URL of the client computer.

The content file:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

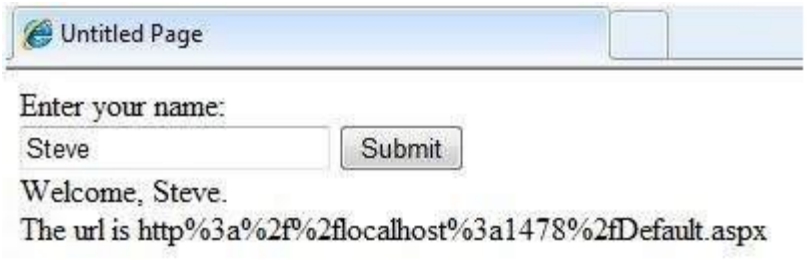
```
  Inherits="server_side._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>Untitled Page</title>
  </head>

  <body>
    <form id="form1" runat="server">
      <div>

        Enter your name:
        <br />
        <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox>
        <asp:Button ID="Button1" runat="server" OnClick="Button1_Click" Text="Submit" />
        <br />
        <asp:Label ID="Label1" runat="server"/>

      </div>
    </form>
  </body>

</html>
```

The code behind Button1_Click:

```
protected void Button1_Click(object sender, EventArgs e) {

  if (!String.IsNullOrEmpty(TextBox1.Text)) {

    // Access the HttpServerUtility methods through
    // the intrinsic Server object.
    Label1.Text = "Welcome, " + Server.HtmlEncode(TextBox1.Text) + ". <br/> The url is " +
Server.UrlEncode(Request.Url.ToString())
  }
}
```

Run the page to see the following result:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en



ASP.NET - Server Controls

Controls are small building blocks of the graphical user interface, which include text boxes, buttons, check boxes, list boxes, labels, and numerous other tools. Using these tools, the users can enter data, make selections and indicate their preferences.

Controls are also used for structural jobs, like validation, data access, security, creating master

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

pages, and data manipulation.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ASP.NET uses five types of web controls, which are:

- HTML controls
- HTML Server controls
- ASP.NET Server controls
- ASP.NET Ajax Server controls
- User controls and custom controls

ASP.NET server controls are the primary controls used in ASP.NET. These controls can be grouped into the following categories:

- **Validation controls** - These are used to validate user input and they work by running client-side script.
- **Data source controls** - These controls provides data binding to different data sources.
- **Data view controls** - These are various lists and tables, which can bind to data from data sources for displaying.
- **Personalization controls** - These are used for personalization of a page according to the user preferences, based on user information.
- **Login and security controls** - These controls provide user authentication.
- **Master pages** - These controls provide consistent layout and interface throughout the application.
- **Navigation controls** - These controls help in navigation. For example, menus, tree view etc.
- **Rich controls** - These controls implement special features. For example, AdRotator, FileUpload, and Calendar control.

The syntax for using server controls is:

```
<asp:controlType  ID ="ControlID" runat="server" Property1=value1  [Property2=value2] />
```

In addition, visual studio has the following features, to help produce in error-free coding:

- Dragging and dropping of controls in design view
- IntelliSense feature that displays and auto-completes the properties
- The properties window to set the property values directly

Properties of the Server Controls

ASP.NET server controls with a visual aspect are derived from the WebControl class and inherit all the properties, events, and methods of this class.

The WebControl class itself and some other server controls that are not visually rendered are derived from the System.Web.UI.Control class. For example, PlaceHolder control or XML control.

ASP.Net server controls inherit all properties, events, and methods of the WebControl and System.Web.UI.Control class.

The following table shows the inherited properties, common to all server controls:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Property	Description
AccessKey	Pressing this key with the Alt key moves focus to the control.
Attributes	It is the collection of arbitrary attributes (for rendering only) that do not correspond to properties on the control.
BackColor	Background color.
BindingContainer	The control that contains this control's data binding.
BorderColor	Border color.
BorderStyle	Border style.
BorderWidth	Border width.
CausesValidation	Indicates if it causes validation.
ChildControlCreated	It indicates whether the server control's child controls have been created.
ClientID	Control ID for HTML markup.
Context	The HttpContext object associated with the server control.
Controls	Collection of all controls contained within the control.
ControlStyle	The style of the Web server control.
CssClass	CSS class

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

DataItemContainer	Gets a reference to the naming container if the naming container implements IDataItemContainer.
DataKeysContainer	Gets a reference to the naming container if the naming container implements IDataKeysControl.
DesignMode	It indicates whether the control is being used on a design surface.
DisabledCssClass	Gets or sets the CSS class to apply to the rendered HTML element when the control is disabled.
Enabled	Indicates whether the control is grayed out.
EnableTheming	Indicates whether theming applies to the control.
EnableViewState	Indicates whether the view state of the control is maintained.
Events	Gets a list of event handler delegates for the control.
Font	Font.
Forecolor	Foreground color.
HasAttributes	Indicates whether the control has attributes set.
HasChildViewState	Indicates whether the current server control's child controls have any saved view-state settings.
Height	Height in pixels or %.
ID	Identifier for the control.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

IsChildControlStateCleared	Indicates whether controls contained within this control have control state.
IsEnabled	Gets a value indicating whether the control is enabled.
IsTrackingViewState	It indicates whether the server control is saving changes to its view state.
IsViewStateEnabled	It indicates whether view state is enabled for this control.
LoadViewStateById	It indicates whether the control participates in loading its view state by ID instead of index.
Page	Page containing the control.
Parent	Parent control.
RenderingCompatibility	It specifies the ASP.NET version that the rendered HTML will be compatible with.
Site	The container that hosts the current control when rendered on a design surface.
SkinID	Gets or sets the skin to apply to the control.
Style	Gets a collection of text attributes that will be rendered as a style attribute on the outer tag of the Web server control.
TabIndex	Gets or sets the tab index of the Web server control.
TagKey	Gets the HtmlTextWriterTag value that corresponds to this Web server control.
TagName	Gets the name of the control tag.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

TemplateControl	The template that contains this control.
TemplateSourceDirectory	Gets the virtual directory of the page or control containing this control.
ToolTip	Gets or sets the text displayed when the mouse pointer hovers over the web server control.
UniqueID	Unique identifier.
ViewState	Gets a dictionary of state information that saves and restores the view state of a server control across multiple requests for the same page.
ViewStateIgnoreCase	It indicates whether the StateBag object is case-insensitive.
ViewStateMode	Gets or sets the view-state mode of this control.
Visible	It indicates whether a server control is visible.
Width	Gets or sets the width of the Web server control.

Methods of the Server Controls

The following table provides the methods of the server controls:

Method	Description
AddAttributesToRender	Adds HTML attributes and styles that need to be rendered to the specified HtmlTextWriterTag.
AddedControl	Called after a child control is added to the Controls

	collection of the control object.
AddParsedSubObject	Notifies the server control that an element, either XML or HTML, was parsed, and adds the element to the server control's control collection.
ApplyStyleSheetSkin	Applies the style properties defined in the page style sheet to the control.
ClearCachedClientID	Infrastructure. Sets the cached ClientID value to null.
ClearChildControlState	Deletes the control-state information for the server control's child controls.
ClearChildState	Deletes the view-state and control-state information for all the server control's child controls.
ClearChildViewState	Deletes the view-state information for all the server control's child controls.
CreateChildControls	Used in creating child controls.
CreateControlCollection	Creates a new ControlCollection object to hold the child controls.
CreateControlStyle	Creates the style object that is used to implement all style related properties.
DataBind	Binds a data source to the server control and all its child controls.
DataBind(Boolean)	Binds a data source to the server control and all its child controls with an option to raise the DataBinding event.
DataBindChildren	Binds a data source to the server control's child controls.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Dispose	Enables a server control to perform final clean up before it is released from memory.
EnsureChildControls	Determines whether the server control contains child controls. If it does not, it creates child controls.
EnsureID	Creates an identifier for controls that do not have an identifier.
Equals(Object)	Determines whether the specified object is equal to the current object.
Finalize	Allows an object to attempt to free resources and perform other cleanup operations before the object is reclaimed by garbage collection.
FindControl(String)	Searches the current naming container for a server control with the specified id parameter.
FindControl(String, Int32)	Searches the current naming container for a server control with the specified id and an integer.
Focus	Sets input focus to a control.
GetDesignModeState	Gets design-time data for a control.
GetType	Gets the type of the current instance.
GetUniqueIDRelativeTo	Returns the prefixed portion of the UniqueID property of the specified control.
HasControls	Determines if the server control contains any child

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	controls.
HasEvents	Indicates whether events are registered for the control or any child controls.
IsLiteralContent	Determines if the server control holds only literal content.
LoadControlState	Restores control-state information.
LoadViewState	Restores view-state information.
MapPathSecure	Retrieves the physical path that a virtual path, either absolute or relative, maps to.
MemberwiseClone	Creates a shallow copy of the current object.
MergeStyle	Copies any nonblank elements of the specified style to the web control, but does not overwrite any existing style elements of the control.
OnBubbleEvent	Determines whether the event for the server control is passed up the page's UI server control hierarchy.
OnDataBinding	Raises the data binding event.
OnInit	Raises the Init event.
OnLoad	Raises the Load event.
OnPreRender	Raises the PreRender event.
OnUnload	Raises the Unload event.
OpenFile	Gets a Stream used to read a file.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

RemovedControl	Called after a child control is removed from the controls collection of the control object.
Render	Renders the control to the specified HTML writer.
RenderBeginTag	Renders the HTML opening tag of the control to the specified writer.
RenderChildren	Outputs the contents of a server control's children to a provided HtmlTextWriter object, which writes the contents to be rendered on the client.
RenderContents	Renders the contents of the control to the specified writer.
RenderControl(HtmlTextWriter)	Outputs server control content to a provided HtmlTextWriter object and stores tracing information about the control if tracing is enabled.
RenderEndTag	Renders the HTML closing tag of the control into the specified writer.
ResolveAdapter	Gets the control adapter responsible for rendering the specified control.
SaveControlState	Saves any server control state changes that have occurred since the time the page was posted back to the server.
SaveViewState	Saves any state that was modified after the TrackViewState method was invoked.
SetDesignModeState	Sets design-time data for a control.
ToString	Returns a string that represents the current object.

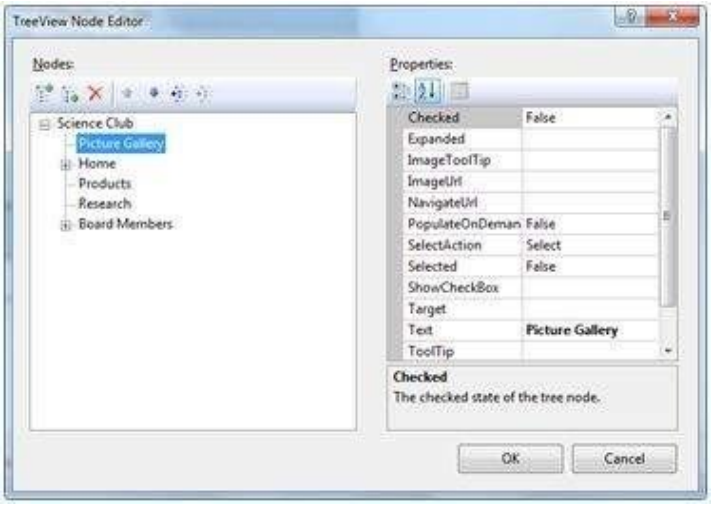
Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

TrackViewState	Causes the control to track changes to its view state so that they can be stored in the object's view state property.

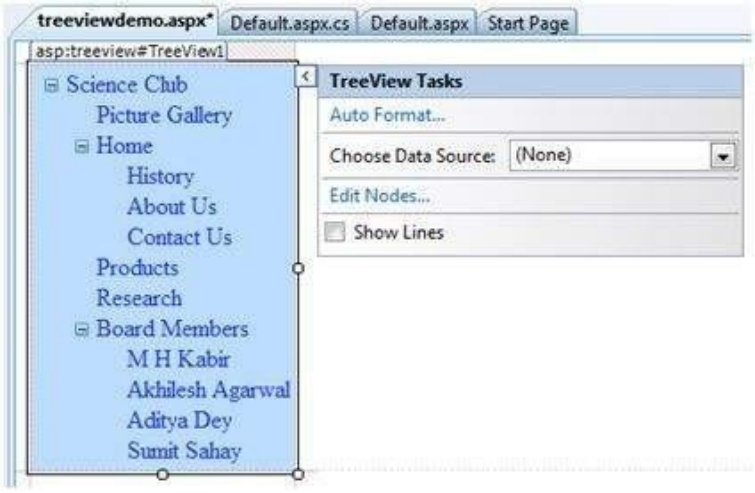
Example

Let us look at a particular server control - a tree view control. A Tree view control comes under navigation controls. Other Navigation controls are: Menu control and SiteMapPath control.

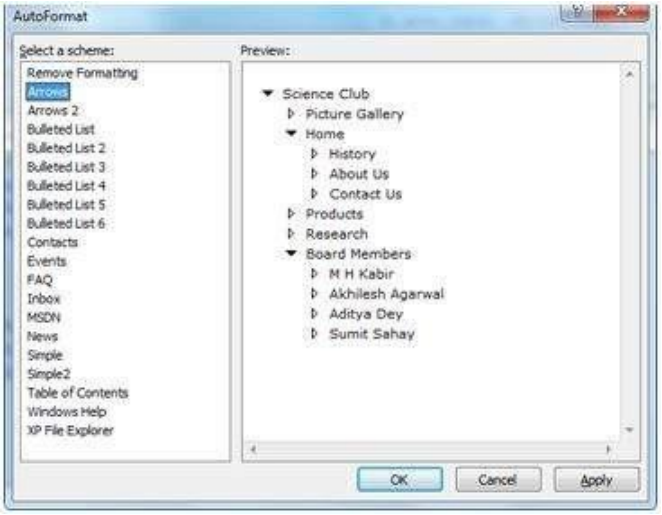
Add a tree view control on the page. Select Edit Nodes... from the tasks. Edit each of the nodes using the Tree view node editor as shown:



Once you have created the nodes, it looks like the following in design view:



The AutoFormat... task allows you to format the tree view as shown:



Add a label control and a text box control on the page and name them lblmessage and txtmessage respectively.

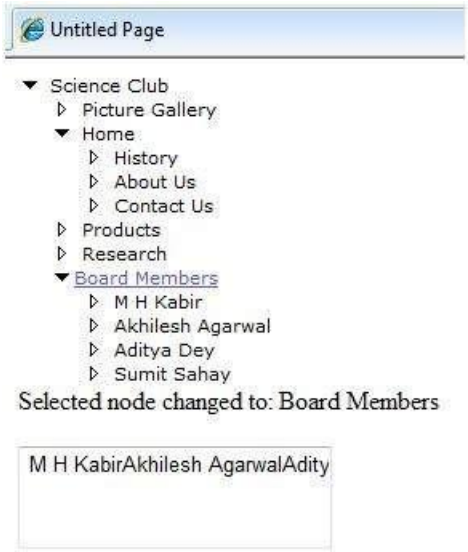
Write a few lines of code to ensure that when a particular node is selected, the label control displays the node text and the text box displays all child nodes under it, if any. The code behind the file should look like this:

```
using System;
using System.Collections;
using System.Configuration;
using System.Data;
using System.Linq;

using System.Web;
using System.Web.Security;
using System.Web.UI;
using System.Web.UI.HtmlControls;
using System.Web.UI.WebControls;
using System.Web.UI.WebControls.WebParts;

using System.Xml.Linq;

namespace eventdemo {
  public partial class treeviewdemo : System.Web.UI.Page {

    protected void Page_Load(object sender, EventArgs e) {
      txtmessage.Text = " ";
    }

    protected void TreeView1_SelectedNodeChanged(object sender, EventArgs e) {

      txtmessage.Text = " ";
      lblmessage.Text = "Selected node changed to: " + TreeView1.SelectedNode.Text;
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
        TreeNodeCollection childnodes = TreeView1.SelectedNode.ChildNodes;

        if(childnodes != null) {
          txtmessage.Text = " ";

          foreach (TreeNode t in childnodes) {
            txtmessage.Text += t.Value;
          }
        }
      }
    }
}
```

Execute the page to see the effects. You will be able to expand and collapse the nodes.



ASP.NET - HTML Server

The HTML server controls are basically the standard HTML controls enhanced to enable server side processing. The HTML controls such as the header tags, anchor tags, and input elements are not processed by the server but are sent to the browser for display.

They are specifically converted to a server control by adding the attribute runat="server" and adding an id attribute to make them available for server-side processing.

For example, consider the HTML input control:

```
<input type="text" size="40">
```

It could be converted to a server control, by adding the runat and id attribute:

```
<input type="text" id="testtext" size="40" runat="server">
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Advantages of using HTML Server Controls

Although ASP.NET server controls can perform every job accomplished by the HTML server controls, the later controls are useful in the following cases:

- Using static tables for layout purposes.
- Converting a HTML page to run under ASP.NET

The following table describes the HTML server controls:

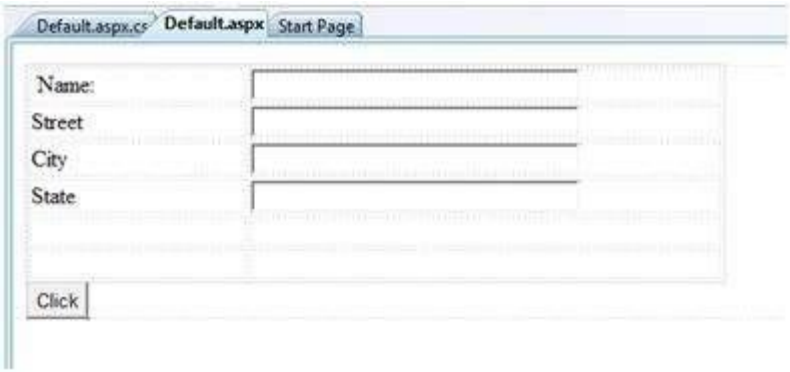
Control Name	HTML tag
HtmlHead	<head>element
HtmlInputButton	<input type=button|submit|reset>
HtmlInputCheckbox	<input type=checkbox>
HtmlInputFile	<input type = file>
HtmlInputHidden	<input type = hidden>
HtmlInputImage	<input type = image>
HtmlInputPassword	<input type = password>
HtmlInputRadioButto	<input type = radio>
HtmlInputReset	<input type = reset>
HtmlText	<input type = text|password>
HtmlImage	<img> element
HtmlLink	<link> element
HtmlAnchor	<a> element
HtmlButton	<button> element
HtmlButton	<button> element
HtmlForm	<form> element
HtmlTable	<table> element
HtmlTableCell	<td> and <th>
HtmlTableRow	<tr> element
HtmlTitle	<title> element
HtmlSelect	<select&t; element
HtmlGenericControl	All HTML controls not listed

Example

The following example uses a basic HTML table for layout. It uses some boxes for getting input from the users such as name, address, city, state etc. It also has a button control, which is clicked to get the user data displayed in the last row of the table.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

The page should look like this in the design view:



The code for the content page shows the use of the HTML table element for layout.

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
Inherits="htmlserver._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>Untitled Page</title>

    <style type="text/css">
      .style1
      {
        width: 156px;
      }
      .style2
      {
        width: 332px;
      }
    </style>

  </head>

  <body>
    <form id="form1" runat="server">
      <div>
        <table style="width: 54%;">
          <tr>
            <td class="style1">Name:</td>
            <td class="style2">
              <asp:TextBox ID="txtname" runat="server"  style="width:230px">
              </asp:TextBox>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
            </td>
          </tr>

          <tr>
            <td class="style1">Street</td>
            <td class="style2">
              <asp:TextBox ID="txtstreet" runat="server"  style="width:230px">
              </asp:TextBox>
            </td>
          </tr>

          <tr>
            <td class="style1">City</td>
            <td class="style2">
              <asp:TextBox ID="txtcity" runat="server"  style="width:230px">
              </asp:TextBox>
            </td>
          </tr>

          <tr>
            <td class="style1">State</td>
            <td class="style2">
              <asp:TextBox ID="txtstate" runat="server" style="width:230px">
              </asp:TextBox>
            </td>
          </tr>

          <tr>
            <td class="style1"> </td>
            <td class="style2"></td>
          </tr>

          <tr>
            <td class="style1"></td>
            <td ID="displayrow" runat ="server" class="style2">
            </td>
          </tr>
        </table>

      </div>
      <asp:Button ID="Button1" runat="server" onclick="Button1_Click" Text="Click" />
    </form>
  </body>
</html>
```

The code behind the button control:

```
protected void Button1_Click(object sender, EventArgs e)
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
{
  string str = "";
  str += txtname.Text + "<br />";
  str += txtstreet.Text + "<br />";
  str += txtcity.Text + "<br />";
  str += txtstate.Text + "<br />";
  displayrow.InnerHtml = str;
}
```

Observe the following:

- The standard HTML tags have been used for the page layout.
- The last row of the HTML table is used for data display. It needed server side processing, so an ID attribute and the runat attribute has been added to it.

ASP.NET - Client Side

ASP.NET client side coding has two aspects:

- **Client side scripts** : It runs on the browser and in turn speeds up the execution of page. For example, client side data validation which can catch invalid data and warn the user accordingly without making a round trip to the server.
- **Client side source code** : ASP.NET pages generate this. For example, the HTML source code of an ASP.NET page contains a number of hidden fields and automatically injected blocks of JavaScript code, which keeps information like view state or does other jobs to make the page work.

Client Side Scripts

All ASP.NET server controls allow calling client side code written using JavaScript or VBScript. Some ASP.NET server controls use client side scripting to provide response to the users without posting back to the server. For example, the validation controls.

Apart from these scripts, the Button control has a property OnClientClick, which allows executing client-side script, when the button is clicked.

The traditional and server HTML controls have the following events that can execute a script when they are raised:

Event	Description
onblur	When the control loses focus

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

onfocus	When the control receives focus
onclick	When the control is clicked
onchange	When the value of the control changes
onkeydown	When the user presses a key
onkeypress	When the user presses an alphanumeric key
onkeyup	When the user releases a key
onmouseover	When the user moves the mouse pointer over the control
onserverclick	It raises the ServerClick event of the control, when the control is clicked

Client Side Source Code

We have already discussed that, ASP.NET pages are generally written in two files:

- The content file or the markup file (.aspx)
- The code-behind file

The content file contains the HTML or ASP.NET control tags and literals to form the structure of the page. The code behind file contains the class definition. At run-time, the content file is parsed and transformed into a page class.

This class, along with the class definition in the code file, and system generated code, together make the executable code (assembly) that processes all posted data, generates response, and sends it back to the client.

Consider the simple page:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
  Inherits="clientside._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>
      Untitled Page
    </title>
  </head>

  <body>
    <form id="form1" runat="server">

      <div>
        <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
        <asp:Button ID="Button1" runat="server" OnClick="Button1_Click" Text="Click" />
      </div>

      <hr />

      <h3> <asp:Label ID="Msg" runat="server" Text=""> </asp:Label> </h3>
    </form>
  </body>

</html>
```

When this page is run on the browser, the View Source option shows the HTML page sent to the browser by the ASP.Net runtime:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head>
    <title>
      Untitled Page
    </title>
  </head>

  <body>
    <form name="form1" method="post" action="Default.aspx" id="form1">

      <div>
        <input type="hidden" name="__VIEWSTATE" id="__VIEWSTATE"

value="/wEPDwUKMTU5MTA2ODYwOWRk31NudGDgvhhA7joJum9Qn5RxU2M=" />
      </div>

      <div>
        <input type="hidden" name="_EVENTVALIDATION"
id="_EVENTVALIDATION"

value="/wEWAwKpjZj0DALs0bLrBgKM54rGBhHsyM61rraxE+KnBTCS8cd1QDJ/"/>
      </div>

      <div>
        <input name="TextBox1" type="text" id="TextBox1" />
        <input type="submit" name="Button1" value="Click" id="Button1" />
      </div>

      <hr />
      <h3><span id="Msg"></span></h3>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
    </form>
  </body>
</html>
```

If you go through the code properly, you can see that first two tags contain the hidden fields which store the view state and validation information.

ASP.NET - Basic Controls

Button Controls

ASP.NET provides three types of button control:

- **Button** : It displays text within a rectangular area.
- **Link Button** : It displays text that looks like a hyperlink.
- **Image Button** : It displays an image.

When a user clicks a button, two events are raised: Click and Command.

Basic syntax of button control:

```
<asp:Button ID="Button1" runat="server" onclick="Button1_Click" Text="Click" / >
```

Common properties of the button control:

Property	Description
Text	The text displayed on the button. This is for button and link button controls only.
ImageUrl	For image button control only. The image to be displayed for the button.
AlternateText	For image button control only. The text to be displayed if the browser cannot display the image.
CausesValidation	Determines whether page validation occurs when a user clicks

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	the button. The default is true.
CommandName	A string value that is passed to the command event when a user clicks the button.
CommandArgument	A string value that is passed to the command event when a user clicks the button.
PostBackUrl	The URL of the page that is requested when the user clicks the button.

Text Boxes and Labels

Text box controls are typically used to accept input from the user. A text box control can accept one or more lines of text depending upon the settings of the TextMode attribute.

Label controls provide an easy way to display text which can be changed from one execution of a page to the next. If you want to display text that does not change, you use the literal text.

Basic syntax of text control:

```
<asp:TextBox ID="txtstate" runat="server" ></asp:TextBox>
```

Common Properties of the Text Box and Labels:

Property	Description
TextMode	Specifies the type of text box. SingleLine creates a standard text box, MultiLIne creates a text box that accepts more than one line of text and the Password causes the characters that are entered to be masked. The default is SingleLine.
Text	The text content of the text box.
MaxLength	The maximum number of characters that can be entered into the text box.
Wrap	It determines whether or not text wraps automatically for multi-line text box; default is true.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ReadOnly	Determines whether the user can change the text in the box; default is false, i.e., the user can not change the text.
Columns	The width of the text box in characters. The actual width is determined based on the font that is used for the text entry.
Rows	The height of a multi-line text box in lines. The default value is 0, means a single line text box.

The mostly used attribute for a label control is 'Text', which implies the text displayed on the label.

Check Boxes and Radio Buttons

A check box displays a single option that the user can either check or uncheck and radio buttons present a group of options from which the user can select just one option.

To create a group of radio buttons, you specify the same name for the GroupName attribute of each radio button in the group. If more than one group is required in a single form, then specify a different group name for each group.

If you want check box or radio button to be selected when the form is initially displayed, set its Checked attribute to true. If the Checked attribute is set to true for multiple radio buttons in a group, then only the last one is considered as true.

Basic syntax of check box:

```
<asp:CheckBox ID= "chkoption" runat= "Server">
</asp:CheckBox>
```

Basic syntax of radio button:

```
<asp:RadioButton ID= "rdboption" runat= "Server">
</asp: RadioButton>
```

Common properties of check boxes and radio buttons:

Property	Description
Text	The text displayed next to the check box or radio button.
Checked	Specifies whether it is selected or not, default is false.
GroupName	Name of the group the control belongs to.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

List Controls

ASP.NET provides the following controls

- Drop-down list,
- List box,
- Radio button list,
- Check box list,
- Bulleted list.

These control let a user choose from one or more items from the list. List boxes and drop-down lists contain one or more list items. These lists can be loaded either by code or by the ListItemCollection editor.

Basic syntax of list box control:

```
<asp:ListBox ID="ListBox1" runat="server" AutoPostBack="True"
OnSelectedIndexChanged="ListBox1_SelectedIndexChanged">
</asp:ListBox>
```

Basic syntax of drop-down list control:

```
<asp:DropDownList ID="DropDownList1" runat="server" AutoPostBack="True"
OnSelectedIndexChanged="DropDownList1_SelectedIndexChanged">
</asp:DropDownList>
```

Common properties of list box and drop-down Lists:

Property	Description
Items	The collection of ListItem objects that represents the items in the control. This property returns an object of type ListItemCollection.
Rows	Specifies the number of items displayed in the box. If actual list contains more rows than displayed then a scroll bar is added.
SelectedIndex	The index of the currently selected item. If more than one item is selected, then the index of the first selected item. If

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	no item is selected, the value of this property is -1.
SelectedValue	The value of the currently selected item. If more than one item is selected, then the value of the first selected item. If no item is selected, the value of this property is an empty string ("").
SelectionMode	Indicates whether a list box allows single selections or multiple selections.

Common properties of each list item objects:

Property	Description
Text	The text displayed for the item.
Selected	Indicates whether the item is selected.
Value	A string value associated with the item.

It is important to notes that:

- To work with the items in a drop-down list or list box, you use the Items property of the control. This property returns a ListItemCollection object which contains all the items of the list.
- The SelectedIndexChanged event is raised when the user selects a different item from a drop-down list or list box.

The ListItemCollection

The ListItemCollection object is a collection of ListItem objects. Each ListItem object represents one item in the list. Items in a ListItemCollection are numbered from 0.

When the items into a list box are loaded using strings like: lstcolor.Items.Add("Blue"), then both the Text and Value properties of the list item are set to the string value you specify. To set it differently you must create a list item object and then add that item to the collection.

The ListItemCollection Editor is used to add item to a drop-down list or list box. This is used to create a static list of items. To display the collection editor, select edit item from the smart tag menu, or select the control and then click the ellipsis button from the Item property in the properties window.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Common properties of ListItemCollection:

Property	Description
Item(integer)	A ListItem object that represents the item at the specified index.
Count	The number of items in the collection.

Common methods of ListItemCollection:

Methods	Description
Add(string)	Adds a new item at the end of the collection and assigns the string parameter to the Text property of the item.
Add(ListItem)	Adds a new item at the end of the collection.
Insert(integer, string)	Inserts an item at the specified index location in the collection, and assigns string parameter to the text property of the item.
Insert(integer, ListItem)	Inserts the item at the specified index location in the collection.
Remove(string)	Removes the item with the text value same as the string.
Remove(ListItem)	Removes the specified item.
RemoveAt(integer)	Removes the item at the specified index as the integer.
Clear	Removes all the items of the collection.
FindByValue(string)	Returns the item whose value is same as the string.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

FindByValue(Text)	Returns the item whose text is same as the string.

Radio Button list and Check Box list

A radio button list presents a list of mutually exclusive options. A check box list presents a list of independent options. These controls contain a collection of ListItem objects that could bereferred to through the Items property of the control.

Basic syntax of radio button list:

```
<asp:RadioButtonList ID="RadioButtonList1" runat="server" AutoPostBack="True"
  OnSelectedIndexChanged="RadioButtonList1_SelectedIndexChanged">
</asp:RadioButtonList>
```

Basic syntax of check box list:

```
<asp:CheckBoxList ID="CheckBoxList1" runat="server" AutoPostBack="True"
  OnSelectedIndexChanged="CheckBoxList1_SelectedIndexChanged">
</asp:CheckBoxList>
```

Common properties of check box and radio button lists:

Property	Description
RepeatLayout	This attribute specifies whether the table tags or the normal html flow to use while formatting the list when it is rendered. The default is Table.
RepeatDirection	It specifies the direction in which the controls to be repeated. The values available are Horizontal and Vertical. Default is Vertical.
RepeatColumns	It specifies the number of columns to use when repeating the controls; default is 0.

Bulleted lists and Numbered lists

The bulleted list control creates bulleted lists or numbered lists. These controls contain a collection of ListItem objects that could be referred to through the Items property of the control.

Basic syntax of a bulleted list:

```
<asp:BulletedList ID="BulletedList1" runat="server">
</asp:BulletedList>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Common properties of the bulleted list:

Property	Description
BulletStyle	This property specifies the style and looks of the bullets, or
RepeatDirection	It specifies the direction in which the controls to be repeated. The values available are Horizontal and Vertical. Default is Vertical.
RepeatColumns	It specifies the number of columns to use when repeating

HyperLink Control

The HyperLink control is like the HTML <a> element.

Basic syntax for a hyperlink control:

```
<asp:HyperLink ID="HyperLink1" runat="server">
  HyperLink
</asp:HyperLink>
```

It has the following important properties:

Property	Description
ImageUrl	Path of the image to be displayed by the control.
NavigateUrl	Target link URL.
Text	The text to be displayed as the link.
Target	The window or frame which loads the linked page.

Image Control

The image control is used for displaying images on the web page, or some alternative text, if the image is not available.

Basic syntax for an image control:

```
<asp:Image ID="Image1" runat="server">
```

It has the following important properties:

Property	Description
AlternateTex	Alternate text to be displayed in absence of the image.
ImageAlign	Alignment options for the control.
ImageUrl	Path of the image to be displayed by the control.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ASP.NET – Validators

ASP.NET validation controls validate the user input data to ensure that useless, unauthenticated, or contradictory data don't get stored.

ASP.NET provides the following validation controls:

- RequiredFieldValidator
- RangeValidator
- CompareValidator
- RegularExpressionValidator
- CustomValidator
- ValidationSummary

BaseValidator Class

The validation control classes are inherited from the BaseValidator class hence they inherit its properties and methods. Therefore, it would help to take a look at the properties and the methods of this base class, which are common for all the validation controls:

Members	Description
ControlToValidate	Indicates the input control to validate.
Display	Indicates how the error message is shown.
EnableClientScrip	Indicates whether client side validation will take.
Enabled	Enables or disables the validator.
ErrorMessage	Indicates error string.
Text	Error text to be shown if validation fails.
IsValid	Indicates whether the value of the control is valid.
SetFocusOnError	It indicates whether in case of an invalid control, the focus should switch to the related input control.
ValidationGroup	The logical group of multiple validators, where this control belongs.
Validate()	This method revalidates the control and updates the IsValid property.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

RequiredFieldValidator Control

The RequiredFieldValidator control ensures that the required field is not empty. It is generally tied to a text box to force input into the text box.

The syntax of the control is as given:

```
<asp:RequiredFieldValidator ID="rfvcandidate"
  runat="server" ControlToValidate ="ddlcandidate"
  ErrorMessage="Please choose a candidate"
  InitialValue="Please choose a candidate">

</asp:RequiredFieldValidator>
```

RangeValidator Control

The RangeValidator control verifies that the input value falls within a predetermined range.

It has three specific properties:

Properties	Description
Type	It defines the type of the data. The available values are: Currency, Date, Double, Integer, and String.
MinimumValue	It specifies the minimum value of the range.
MaximumValu	It specifies the maximum value of the range.

The syntax of the control is as given:

```
<asp:RangeValidator ID="rvclass" runat="server" ControlToValidate="txtclass"
  ErrorMessage="Enter your class (6 - 12)" MaximumValue="12"
  MinimumValue="6" Type="Integer">

</asp:RangeValidator>
```

CompareValidator Control

The CompareValidator control compares a value in one control with a fixed value or a value in another control.

It has the following specific properties:

Properties	Description
Type	It specifies the data type.
ControlToCompare	It specifies the value of the input control to compare with.
ValueToCompare	It specifies the constant value to compare with.
Operator	It specifies the comparison operator, the available values are:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	Equal, NotEqual, GreaterThan, GreaterThanEqual, LessThan, LessThanEqual, and DataTypeCheck.

The basic syntax of the control is as follows:

```
<asp:CompareValidator ID="CompareValidator1" runat="server"
  ErrorMessage="CompareValidator">

</asp:CompareValidator>
```

RegularExpressionValidator

The RegularExpressionValidator allows validating the input text by matching against a pattern of a regular expression. The regular expression is set in the ValidationExpression property.

The following table summarizes the commonly used syntax constructs for regular expressions:

Character	Description
\b	Matches a backspace.
\t	Matches a tab.
\r	Matches a carriage return.
\v	Matches a vertical tab.
\f	Matches a form feed.
\n	Matches a new line.
\	Escape character.

Apart from single character match, a class of characters could be specified that can be matched, called the metacharacters.

Metacharacter	Description
.	Matches any character except \n.
[abcd]	Matches any character in the set.
[^abcd]	Excludes any character in the set.
[2-7a-mA-M]	Matches any character specified in the range.
\w	Matches any alphanumeric character and underscore.
\W	Matches any non-word character.
\s	Matches whitespace characters like, space, tab, new line etc.
\S	Matches any non-whitespace character.
\d	Matches any decimal character.
\D	Matches any non-decimal character.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Quantifiers could be added to specify number of times a character could appear.

Quantifier	Description
*	Zero or more matches.
+	One or more matches.
?	Zero or one matches.
{N}	N matches.
{N,}	N or more matches.
{N,M}	Between N and M matches.

The syntax of the control is as given:

```
<asp:RegularExpressionValidator ID="string" runat="server" ErrorMessage="string"
  ValidationExpression="string" ValidationGroup="string">

</asp:RegularExpressionValidator>
```

CustomValidator

The CustomValidator control allows writing application specific custom validation routines for both the client side and the server side validation.

The client side validation is accomplished through the ClientValidationFunction property. The client side validation routine should be written in a scripting language, such as JavaScript or VBScript, which the browser can understand.

The server side validation routine must be called from the control's ServerValidate event handler. The server side validation routine should be written in any .Net language, like C# or VB.Net.

The basic syntax for the control is as given:

```
<asp:CustomValidator ID="CustomValidator1" runat="server"
  ClientValidationFunction=.cvf_func. ErrorMessage="CustomValidator">

</asp:CustomValidator>
```

ValidationSummary

The ValidationSummary control does not perform any validation but shows a summary of all errors in the page. The summary displays the values of the ErrorMessage property of all validation controls that failed validation.

The following two mutually inclusive properties list out the error message:

- **ShowSummary** : shows the error messages in specified format.
- **ShowMessageBox** : shows the error messages in a separate window.

The syntax for the control is as given:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
<asp:ValidationSummary ID="ValidationSummary1" runat="server"
  DisplayMode = "BulletList" ShowSummary = "true" HeaderText="Errors:" />
```

Validation Groups

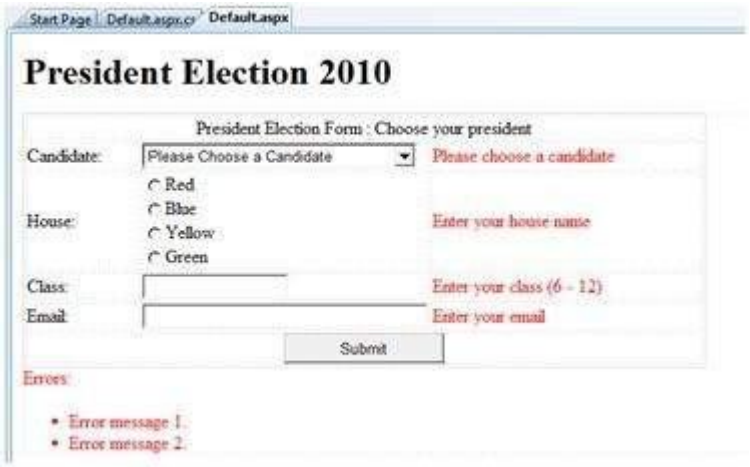
Complex pages have different groups of information provided in different panels. In suchsituation, a need might arise for performing validation separately for separate group. This kind ofsituation is handled using validation groups.

To create a validation group, you should put the input controls and the validation controls into the same logical group by setting their *ValidationGroup* property.

Example

The following example describes a form to be filled up by all the students of a school, divided into four houses, for electing the school president. Here, we use the validation controls tovalidate the user input.

This is the form in design view:



The content file code is as given:

```
<form id="form1" runat="server">

  <table style="width: 66%;">

    <tr>
      <td class="style1" colspan="3" align="center">
      <asp:Label ID="lblmsg"
        Text="President Election Form : Choose your president"
        runat="server" />
      </td>
    </tr>

    <tr>
      <td class="style3">
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
      Candidate:
    </td>

    <td class="style2">
      <asp:DropDownList ID="ddlcandidate" runat="server"  style="width:239px">
        <asp:ListItem>Please Choose a Candidate</asp:ListItem>
        <asp:ListItem>M H Kabir</asp:ListItem>
        <asp:ListItem>Steve Taylor</asp:ListItem>
        <asp:ListItem>John Abraham</asp:ListItem>
        <asp:ListItem>Venus Williams</asp:ListItem>
      </asp:DropDownList>
    </td>

    <td>
      <asp:RequiredFieldValidator ID="rfvcandidate"
        runat="server" ControlToValidate ="ddlcandidate"
        ErrorMessage="Please choose a candidate"
        InitialValue="Please choose a candidate">
      </asp:RequiredFieldValidator>
    </td>
  </tr>

  <tr>
    <td class="style3">
      House:
    </td>

    <td class="style2">
      <asp:RadioButtonList ID="rblhouse" runat="server" RepeatLayout="Flow">
        <asp:ListItem>Red</asp:ListItem>
        <asp:ListItem>Blue</asp:ListItem>
        <asp:ListItem>Yellow</asp:ListItem>
        <asp:ListItem>Green</asp:ListItem>
      </asp:RadioButtonList>
    </td>

    <td>
      <asp:RequiredFieldValidator ID="rfvhouse" runat="server"
        ControlToValidate="rblhouse" ErrorMessage="Enter your house name" >
      </asp:RequiredFieldValidator>
      <br />
    </td>
  </tr>

  <tr>
    <td class="style3">
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
        Class:
      </td>

      <td class="style2">
        <asp:TextBox ID="txtclass" runat="server"></asp:TextBox>
      </td>

      <td>
        <asp:RangeValidator ID="rvclass"
          runat="server" ControlToValidate="txtclass"
          ErrorMessage="Enter your class (6 - 12)" MaximumValue="12"
          MinimumValue="6" Type="Integer">
        </asp:RangeValidator>
      </td>
    </tr>

    <tr>
      <td class="style3">
        Email:
      </td>

      <td class="style2">
        <asp:TextBox ID="txtemail" runat="server" style="width:250px">
        </asp:TextBox>
      </td>

      <td>
        <asp:RegularExpressionValidator ID="remail" runat="server"
          ControlToValidate="txtemail" ErrorMessage="Enter your email"
          ValidationExpression="\w+([-+.']\w+)*@\w+([-.]\w+)*\.\w+([-.]\w+)*">
        </asp:RegularExpressionValidator>
      </td>
    </tr>

    <tr>
      <td class="style3" align="center" colspan="3">
        <asp:Button ID="btnsubmit" runat="server" onclick="btnsubmit_Click"
          style="text-align: center" Text="Submit" style="width:140px" />
      </td>
    </tr>
  </table>
  <asp:ValidationSummary ID="ValidationSummary1" runat="server"
    DisplayMode ="BulletList" ShowSummary ="true" HeaderText="Errors:" />
</form>
```

The code behind the submit button:

```
protected void btnsubmit_Click(object sender, EventArgs e)
{
  if (Page.IsValid)
  {
    lblmsg.Text = "Thank You";
  }
  else
  {
    lblmsg.Text = "Fill up all the fields";
  }
}
```

ASP.NET - File Uploading

ASP.NET has two controls that allow users to upload files to the web server. Once the server receives the posted file data, the application can save it, check it, or ignore it. The following controls allow the file uploading:

- **HtmlInputFile** - an HTML server control
- **FileUpload** - and ASP.NET web control

Both controls allow file uploading, but the FileUpload control automatically sets the encoding of the form, whereas the HtmlInputFile does not do so.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

In this tutorial, we use the FileUpload control. The FileUpload control allows the user to browse for and select the file to be uploaded, providing a browse button and a text box for entering the filename.

Once, the user has entered the filename in the text box by typing the name or browsing, the SaveAs method of the FileUpload control can be called to save the file to the disk.

The basic syntax of FileUpload is:

```
<asp:FileUpload ID= "Uploader" runat = "server" />
```

The FileUpload class is derived from the WebControl class, and inherits all its members. Apart from those, the FileUpload class has the following read-only properties:

Properties	Description
FileBytes	Returns an array of the bytes in a file to be uploaded.
FileConten	Returns the stream object pointing to the file to be uploaded.
FileName	Returns the name of the file to be uploaded.
HasFile	Specifies whether the control has a file to upload.
PostedFile	Returns a reference to the uploaded file.

The posted file is encapsulated in an object of type HttpPostedFile, which could be accessed through the PostedFile property of the FileUpload class.

The HttpPostedFile class has the following frequently used properties:

Properties	Description
ContentLengt	Returns the size of the uploaded file in bytes.
ContentType	Returns the MIME type of the uploaded file.
FileName	Returns the full filename.
InputStream	Returns a stream object pointing to the uploaded file.

Example

The following example demonstrates the FileUpload control and its properties. The form has a FileUpload control along with a save button and a label control for displaying the file name, file type, and file length.

In the design view, the form looks as follows:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

The content file code is as given:

```
<body>
  <form id="form1" runat="server">

    <div>
      <h3> File Upload:</h3>
      <br />
      <asp:FileUpload ID="FileUpload1" runat="server" />
      <br /><br />
      <asp:Button ID="btnsave" runat="server" onclick="btnsave_Click"  Text="Save"
style="width:85px" />
      <br /><br />
      <asp:Label ID="lblmessage" runat="server" />
    </div>

  </form>
</body>
```

The code behind the save button is as given:

```
protected void btnsave_Click(object sender, EventArgs e)
{
  StringBuilder sb = new StringBuilder();

  if (FileUpload1.HasFile)
  {
    try
    {
      sb.AppendFormat(" Uploading file: {0}", FileUpload1.FileName);

      //saving the file
      FileUpload1.SaveAs("<c:\\SaveDirectory>" + FileUpload1.FileName);

      //Showing the file information
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
        sb.AppendFormat("<br/> Save As: {0}", FileUpload1.PostedFile.FileName);
        sb.AppendFormat("<br/> File type: {0}",     FileUpload1.PostedFile.ContentType);
        sb.AppendFormat("<br/> File length: {0}", FileUpload1.PostedFile.ContentLength);
        sb.AppendFormat("<br/> File name: {0}",  FileUpload1.PostedFile.FileName);

      }catch (Exception ex)
      {
        sb.Append("<br/> Error <br/>");
        sb.AppendFormat("Unable to save file <br/> {0}", ex.Message);
      }
    }
    else
    {
      lblmessage.Text = sb.ToString();
    }
}
```

Note the following:

- The StringBuilder class is derived from System.IO namespace, so it needs to be included.
- The try and catch blocks are used for catching errors, and display the error message.

ASP.NET - Ad Rotator

The AdRotator control randomly selects banner graphics from a list, which is specified in an external XML schedule file. This external XML schedule file is called the advertisement file.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

The AdRotator control allows you to specify the advertisement file and the type of window that the link should follow in the AdvertisementFile and the Target property respectively.

The basic syntax of adding an AdRotator is as follows:

```
<asp:AdRotator  runat = "server" AdvertisementFile = "adfile.xml"  Target =  "_blank" />
```

Before going into the details of the AdRotator control and its properties, let us look into the construction of the advertisement file.

The Advertisement File

The advertisement file is an XML file, which contains the information about the advertisements to be displayed.

Extensible Markup Language (XML) is a W3C standard for text document markup. It is a text-based markup language that enables you to store data in a structured format by using meaningful tags. The term 'extensible' implies that you can extend your ability to describe a document by defining meaningful tags for the application.

XML is not a language in itself, like HTML, but a set of rules for creating new markup languages. It is a meta-markup language. It allows developers to create custom tag sets forspecial uses. It structures, stores, and transports the information.

Following is an example of XML file:

```
<BOOK>
  <NAME> Learn XML </NAME>
  <AUTHOR> Samuel Peterson </AUTHOR>
  <PUBLISHER> NSS Publications </PUBLISHER>
  <PRICE> $30.00</PRICE>
</BOOK>
```

Like all XML files, the advertisement file needs to be a structured text file with well-defined tags delineating the data. There are the following standard XML elements that are commonly used in the advertisement file:

Element	Description
Advertisements	Encloses the advertisement file.
Ad	Delineates separate ad.
ImageUrl	The path of image that will be displayed.
NavigateUrl	The link that will be followed when the user clicks the ad.
AlternateText	The text that will be displayed instead of the picture if it cannot be displayed.
Keyword	Keyword identifying a group of advertisements. This is used for filtering.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Impressions	The number indicating how often an advertisement will appear.
Height	Height of the image to be displayed.
Width	Width of the image to be displayed.

Apart from these tags, customs tags with custom attributes could also be included. The following code illustrates an advertisement file ads.xml:

```
<Advertisements>
  <Ad>
    <ImageUrl>rose1.jpg</ImageUrl>
    <NavigateUrl>http://www.1800flowers.com</NavigateUrl>
    <AlternateText>
      Order flowers, roses, gifts and more
    </AlternateText>
    <Impressions>20</Impressions>
    <Keyword>flowers</Keyword>
  </Ad>

  <Ad>
    <ImageUrl>rose2.jpg</ImageUrl>
    <NavigateUrl>http://www.babybouquets.com.au</NavigateUrl>
    <AlternateText>Order roses and flowers</AlternateText>
    <Impressions>20</Impressions>
    <Keyword>gifts</Keyword>
  </Ad>

  <Ad>
    <ImageUrl>rose3.jpg</ImageUrl>
    <NavigateUrl>http://www.flowers2moscow.com</NavigateUrl>
    <AlternateText>Send flowers to Russia</AlternateText>
    <Impressions>20</Impressions>
    <Keyword>russia</Keyword>
  </Ad>

  <Ad>
    <ImageUrl>rose4.jpg</ImageUrl>
    <NavigateUrl>http://www.ediblebloomes.com</NavigateUrl>
    <AlternateText>Edible Blooms</AlternateText>
    <Impressions>20</Impressions>
    <Keyword>gifts</Keyword>
  </Ad>
</Advertisements>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Properties and Events of the AdRotator Class

The AdRotator class is derived from the WebControl class and inherits its properties. Apart from those, the AdRotator class has the following properties:

Properties	Description
AdvertisementFile	The path to the advertisement file.
AlternateTextFeild	The element name of the field where alternate text is provided. The default value is AlternateText.
DataMember	The name of the specific list of data to be bound when advertisement file is not used.
DataSource	Control from where it would retrieve data.
DataSourceID	Id of the control from where it would retrieve data.
Font	Specifies the font properties associated with the advertisement banner control.
ImageUrlField	The element name of the field where the URL for the image is provided. The default value is ImageUrl.
KeywordFilter	For displaying the keyword based ads only.
NavigateUrlField	The element name of the field where the URL to navigate to is provided. The default value is NavigateUrl.
Target	The browser window or frame that displays the content of the page linked.
UniqueID	Obtains the unique, hierarchically qualified identifier for the AdRotator control.

Following are the important events of the AdRotator class:

Events	Description
AdCreated	It is raised once per round trip to the server after creation of the control, but before the page is rendered
DataBinding	Occurs when the server control binds to a data source.
DataBound	Occurs after the server control binds to a data source.
Disposed	Occurs when a server control is released from memory, which is the last stage of the server control lifecycle when an ASP.NET page is requested

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Init	Occurs when the server control is initialized, which is the first step in its lifecycle.
Load	Occurs when the server control is loaded into the Page object.
PreRender	Occurs after the Control object is loaded but prior to rendering.
Unload	Occurs when the server control is unloaded from memory.

Working with AdRotator Control

Create a new web page and place an AdRotator control on it.

```
<form id="form1" runat="server">
  <div>
    <asp:AdRotator ID="AdRotator1" runat="server" AdvertisementFile  ="~/ads.xml"
onadcreated="AdRotator1_AdCreated" />
  </div>
</form>
```

The ads.xml file and the image files should be located in the root directory of the web site.

Try to execute the above application and observe that each time the page is reloaded, the ad is changed.

ASP.NET – Calendars

The calendar control is a functionally rich web control, which provides the following capabilities:

- Displaying one month at a time
- Selecting a day, a week or a month
- Selecting a range of days
- Moving from month to month
- Controlling the display of the days programmatically

The basic syntax of a calendar control is:

```
<asp:Calender ID = "Calendar1" runat = "server">
</asp:Calender>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Properties and Events of the Calendar Control

The calendar control has many properties and events, using which you can customize the actions and display of the control. The following table provides some important properties of theCalendar control:

Properties	Description
Caption	Gets or sets the caption for the calendar control.
CaptionAlign	Gets or sets the alignment for the caption.
CellPadding	Gets or sets the number of spaces between the data and the cell border.
CellSpacing	Gets or sets the space between cells.
DayHeaderStyle	Gets the style properties for the section that displays the day of the week.
DayNameFormat	Gets or sets format of days of the week.
DayStyle	Gets the style properties for the days in the displayed month.
FirstDayOfWeek	Gets or sets the day of week to display in the first column.
NextMonthText	Gets or sets the text for next month navigation control. The default value is >.
NextPrevFormat	Gets or sets the format of the next and previous month navigation control.
OtherMonthDayStyle	Gets the style properties for the days on the Calendar control that are not in the displayed month.
PrevMonthText	Gets or sets the text for previous month navigation control. The default value is <.
SelectedDate	Gets or sets the selected date.
SelectedDates	Gets a collection of DateTime objects representing the selected dates.
SelectedDayStyle	Gets the style properties for the selected dates.
SelectionMode	Gets or sets the selection mode that specifies whether the user can select a single day, a week or an entire month.
SelectMonthText	Gets or sets the text for the month selection element in the selector column.
SelectorStyle	Gets the style properties for the week and month selector column.
SelectWeekText	Gets or sets the text displayed for the week selection element in the selector column.
ShowDayHeader	Gets or sets the value indicating whether the heading for the days of the week is displayed.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ShowGridLines	Gets or sets the value indicating whether the gridlines would be shown.
ShowNextPrevMonth	Gets or sets a value indicating whether next and previous month navigation elements are shown in the title section.
ShowTitle	Gets or sets a value indicating whether the title section is displayed.
TitleFormat	Gets or sets the format for the title section.
Titlestyle	Get the style properties of the title heading for the Calendar control.
TodayDayStyle	Gets the style properties for today's date on the Calendar control.
TodaysDate	Gets or sets the value for today's date.
UseAccessibleHeader	Gets or sets a value that indicates whether to render the table header <th> HTML element for the day headers instead of the table data <td> HTML element.
VisibleDate	Gets or sets the date that specifies the month to display.
WeekendDayStyle	Gets the style properties for the weekend dates on the Calendar control.

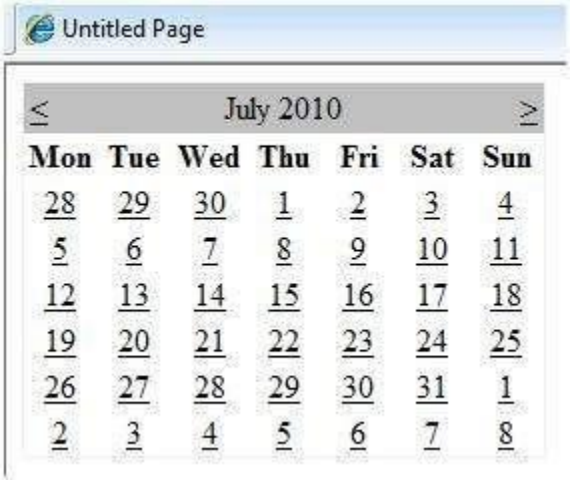
The Calendar control has the following three most important events that allow the developers to program the calendar control. They are:

Events	Description
SelectionChanged	It is raised when a day, a week or an entire month is selected.
DayRender	It is raised when each data cell of the calendar control is rendered.
VisibleMonthChanged	It is raised when user changes a month.

Working with the Calendar Control

Putting a bare-bone calendar control without any code behind file provides a workable calendar to a site, which shows the months and days of the year. It also allows navigation to next and previous months.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en



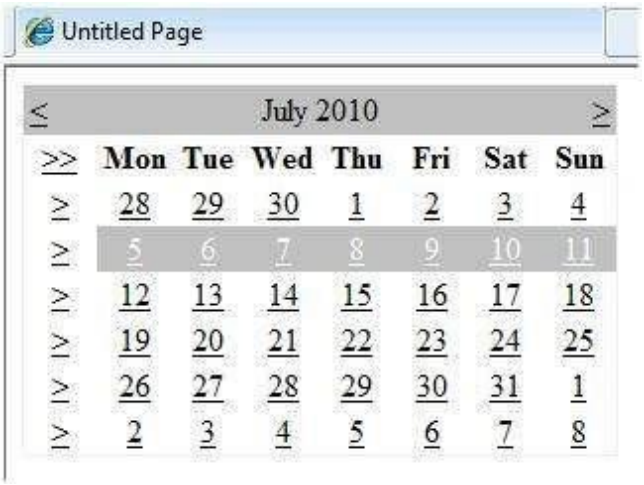
Calendar controls allow the users to select a single day, a week, or an entire month. This is done by using the SelectionMode property. This property has the following values:

Properties	Description
Day	To select a single day.
DayWeek	To select a single day or an entire week.
DayWeekMonth	To select a single day, a week, or an entire month.
None	Nothing can be selected.

The syntax for selecting days:

```
<asp:Calender ID = "Calendar1" runat = "server" SelectionMode="DayWeekMonth">
</asp:Calender>
```

When the selection mode is set to the value DayWeekMonth, an extra column with the > symbol appears for selecting the week, and a >> symbol appears to the left of the days name for selecting the month.



Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Example

The following example demonstrates selecting a date and displays the date in a label:

The content file code is as follows:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
Inherits="calendardemo._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>
      Untitled Page
    </title>
  </head>

  <body>
    <form id="form1" runat="server">

      <div>
        <h3> Your Birthday:</h3>
        <asp:Calendar ID="Calendar1" runat="server  SelectionMode="DayWeekMonth"
onselectionchanged="Calendar1_SelectionChanged">
        </asp:Calendar>
      </div>

      <p>Todays date is:
        <asp:Label ID="lblday" runat="server"></asp:Label>
      </p>

      <p>Your Birday is:
        <asp:Label ID="lblbday" runat="server"></asp:Label>
      </p>

    </form>
  </body>
</html>
```

The event handler for the event SelectionChanged:

```
protected void Calendar1_SelectionChanged(object sender, EventArgs e)
{
  lblday.Text = Calendar1.TodaysDate.ToShortDateString();
  lblbday.Text = Calendar1.SelectedDate.ToShortDateString();
}
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

When the file is run, it should produce the following output:

ASP.NET - Managing State

Hyper Text Transfer Protocol (HTTP) is a stateless protocol. When the client disconnects from the server, the ASP.NET engine discards the page objects. This way, each web application can scale up to serve numerous requests simultaneously without running out of server memory.

However, there needs to be some technique to store the information between requests and to retrieve it when required. This information i.e., the current value of all the controls and variables for the current user in the current session is called the State.

ASP.NET manages four types of states:

- View State
- Control State
- Session State
- Application State

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

View State

The view state is the state of the page and all its controls. It is automatically maintained across posts by the ASP.NET framework.

When a page is sent back to the client, the changes in the properties of the page and its controls are determined, and stored in the value of a hidden input field named _VIEWSTATE. When the page is again posted back, the _VIEWSTATE field is sent to the server with the HTTP request.

The view state could be enabled or disabled for:

- **The entire application** by setting the EnableViewState property in the <pages> section of web.config file.
- **A page** by setting the EnableViewState attribute of the Page directive, as <%@ Page Language="C#" EnableViewState="false" %>
- **A control** by setting the Control.EnableViewState property.

It is implemented using a view state object defined by the StateBag class which defines a collection of view state items. The state bag is a data structure containing attribute value pairs, stored as strings associated with objects.

The StateBag class has the following properties:

Properties	Description
Item(name)	The value of the view state item with the specified name. This is the default property of the StateBag class.
Count	The number of items in the view state collection.
Keys	Collection of keys for all the items in the collection.
Values	Collection of values for all the items in the collection.

The StateBag class has the following methods:

Methods	Description
Add(name, value)	Adds an item to the view state collection and existing item is updated.
Clear	Removes all the items from the collection.
Equals(Object)	Determines whether the specified object is equal to the current object.
Finalize	Allows it to free resources and perform other cleanup

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	operations.
GetEnumerator	Returns an enumerator that iterates over all the key/value pairs of the StateItem objects stored in the StateBag object.
GetType	Gets the type of the current instance.
IsItemDirty	Checks a StateItem object stored in the StateBag object to evaluate whether it has been modified.
Remove(name)	Removes the specified item.
SetDirty	Sets the state of the StateBag object as well as the Dirty property of each of the StateItem objects contained by it.
SetItemDirty	Sets the Dirty property for the specified StateItem object in the StateBag object.
ToString	Returns a string representing the state bag object.

Example

The following example demonstrates the concept of storing view state. Let us keep a counter, which is incremented each time the page is posted back by clicking a button on the page. A label control shows the value in the counter.

The markup file code is as follows:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
Inherits="statedemo._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>
      Untitled Page
    </title>
  </head>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
  <body>
    <form id="form1" runat="server">

      <div>
        <h3>View State demo</h3>

        Page Counter:

        <asp:Label ID="lblCounter" runat="server" />
        <asp:Button ID="btnIncrement" runat="server" Text="Add Count"
onclick="btnIncrement_Click" />
      </div>

    </form>
  </body>

</html>
```

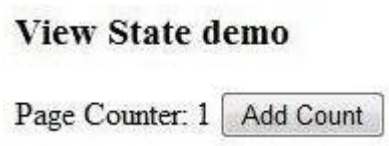
The code behind file for the example is shown here:

```
public partial class _Default : System.Web.UI.Page
{
  public int counter
  {
    get
    {
      if (ViewState["pcounter"] != null)
      {
        return ((int)ViewState["pcounter"]);
      }
      else
      {
        return 0;
      }
    }

    set
    {
      ViewState["pcounter"] = value;
    }
  }

  protected void Page_Load(object sender, EventArgs e)
  {
    lblCounter.Text = counter.ToString();
    counter++;
  }
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
}
```

It would produce the following result:



Control State

Control state cannot be modified, accessed directly, or disabled.

Session State

When a user connects to an ASP.NET website, a new session object is created. When session state is turned on, a new session state object is created for each new request. This session state object becomes part of the context and it is available through the page.

Session state is generally used for storing application data such as inventory, supplier list, customer record, or shopping cart. It can also keep information about the user and his preferences, and keep the track of pending operations.

Sessions are identified and tracked with a 120-bit SessionID, which is passed from client to server and back as cookie or a modified URL. The SessionID is globally unique and random.

The session state object is created from the HttpSessionState class, which defines a collection of session state items.

The HttpSessionState class has the following properties:

Properties	Description
SessionID	The unique session identifier.
Item(name)	The value of the session state item with the specified name. This is the default property of the HttpSessionState class.
Count	The number of items in the session state collection.
TimeOut	Gets and sets the amount of time, in minutes, allowed between requests before the session-state provider terminates the session.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

The HttpSessionState class has the following methods:

Methods	Description
Add(name, value)	Adds an item to the session state collection.
Clear	Removes all the items from session state collection.
Remove(name)	Removes the specified item from the session state collection.
RemoveAll	Removes all keys and values from the session-state collection.
RemoveAt	Deletes an item at a specified index from the session-state collection.

The session state object is a name-value pair to store and retrieve some information from the session state object. You could use the following code for the same:

```
void StoreSessionInfo()
{
   String fromuser = TextBox1.Text;
   Session["fromuser"] = fromuser;
}

void RetrieveSessionInfo()
{
   String fromuser = Session["fromuser"];
   Label1.Text = fromuser;
}
```

The above code stores only strings in the Session dictionary object, however, it can store all the primitive data types and arrays composed of primitive data types, as well as the DataSet, DataTable, HashTable, and Image objects, as well as any user-defined class that inherits from the ISerializable object.

Example

The following example demonstrates the concept of storing session state. There are two buttons on the page, a text box to enter string and a label to display the text stored from last session.

The mark up file code is as follows:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeFile="Default.aspx.cs"
Inherits="_Default"  %>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>
      Untitled Page
    </title>
  </head>

  <body>
    <form id="form1" runat="server">
      <div>
             

        <table style="width: 568px; height: 103px">

          <tr>
            <td style="width: 209px">
              <asp:Label ID="lblstr" runat="server" Text="Enter a String"  style="width:94px">
              </asp:Label>
            </td>

            <td style="width: 317px">
              <asp:TextBox ID="txtstr" runat="server" style="width:227px">
              </asp:TextBox>
            </td>
          </tr>

          <tr>
            <td style="width: 209px"> </td>
            <td style="width: 317px"> </td>
          </tr>

          <tr>
            <td style="width: 209px">
              <asp:Button ID="btnnrm" runat="server"
                Text="No action button" style="width:128px" />
            </td>

            <td style="width: 317px">
              <asp:Button ID="btnstr" runat="server"
                OnClick="btnstr_Click" Text="Submit the String" />
            </td>
          </tr>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
            <tr>
              <td style="width: 209px">  </td>

              <td style="width: 317px">  </td>
            </tr>

            <tr>
              <td style="width: 209px">
                <asp:Label ID="lblsession" runat="server"  style="width:231px"  >
                </asp:Label>
              </td>

              <td style="width: 317px">  </td>
            </tr>

            <tr>
              <td style="width: 209px">
                <asp:Label ID="lblshstr" runat="server">
                </asp:Label>
              </td>

              <td style="width: 317px">  </td>
            </tr>

          </table>

        </div>
      </form>
    </body>
</html>
```

It should look like the following in design view:

The code behind file is given here:

```
public partial class _Default : System.Web.UI.Page
{
  String mystr;
```

```
  protected void Page_Load(object sender, EventArgs e)
  {
    this.lblshstr.Text = this.mystr;
    this.lblsession.Text = (String)this.Session["str"];
  }

  protected void btnstr_Click(object sender, EventArgs e)
  {
    this.mystr = this.txtstr.Text;
    this.Session["str"] = this.txtstr.Text;
    this.lblshstr.Text = this.mystr;
    this.lblsession.Text = (String)this.Session["str"];
  }
}
```

Execute the file and observe how it works:

Application State

The ASP.NET application is the collection of all web pages, code and other files within a single virtual directory on a web server. When information is stored in application state, it is available to all the users.

To provide for the use of application state, ASP.NET creates an application state object for each application from the HTTPApplicationState class and stores this object in server memory. This object is represented by class file global.asax.

Application State is mostly used to store hit counters and other statistical data, global application data like tax rate, discount rate etc. and to keep the track of users visiting the site.

The HttpApplicationState class has the following properties:

Properties	Description
Item(name)	The value of the application state item with the specified name. This is the default property of the HttpApplicationState class.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Count	The number of items in the application state collection.

The HttpApplicationState class has the following methods:

Methods	Description
Add(name, value)	Adds an item to the application state collection.
Clear	Removes all the items from the application state collection.
Remove(name)	Removes the specified item from the application state collection.
RemoveAll	Removes all objects from an HttpApplicationState collection.
RemoveAt	Removes an HttpApplicationState object from a collection by index.
Lock()	Locks the application state collection so only the current user can access it.
Unlock()	Unlocks the application state collection so all the users can access it.

Application state data is generally maintained by writing handlers for the events:

- Application_Start
- Application_End
- Application_Error
- Session_Start
- Session_End

The following code snippet shows the basic syntax for storing application state information:

```
Void Application_Start(object sender, EventArgs e)
{
  Application["startMessage"] = "The application has started.";
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
}

Void Application_End(object sender, EventArgs e)
{
  Application["endtMessage"] = "The application has ended.";
}
```

ASP.NET - Custom Controls

ASP.NET allows the users to create controls. These user defined controls are categorized into:

- User controls
- Custom controls

User Controls

User controls behaves like miniature ASP.NET pages or web forms, which could be used by many other pages. These are derived from the System.Web.UI.UserControl class. These controlshave the following characteristics:

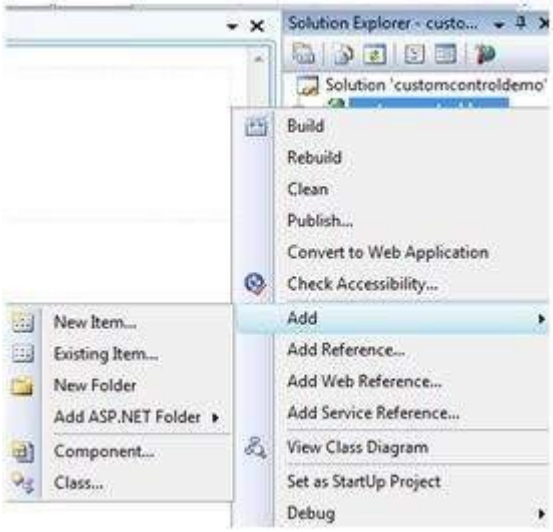
- They have an .ascx extension.
- They may not contain any <html>, <body>, or <form> tags.
- They have a Control directive instead of a Page directive.

To understand the concept, let us create a simple user control, which will work as footer for the web pages. To create and use the user control, take the following steps:

- Create a new web application.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

- Right click on the project folder on the Solution Explorer and choose Add New Item.



- Select Web User Control from the Add New Item dialog box and name it footer.ascx. Initially, the footer.ascx contains only a Control directive.

```
<%@ Control Language="C#" AutoEventWireup="true" CodeBehind="footer.ascx.cs"
  Inherits="customcontroldemo.footer" %>
```

- Add the following code to the file:

```
<table>
   <tr>
      <td align="center"> Copyright ©2010 TutorialPoints Ltd.</td>
   </tr>

   <tr>
      <td align="center"> Location: Hyderabad, A.P </td>
   </tr>
</table>
```

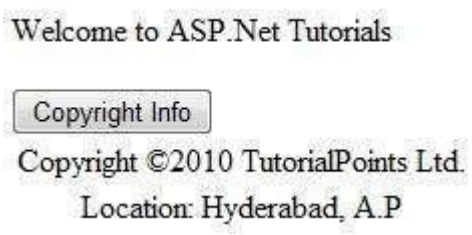
To add the user control to your web page, you must add the Register directive and an instance of the user control to the page. The following code shows the content file:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
Inherits="customcontroldemo._Default" %>

<%@ Register Src="~/footer.ascx" TagName="footer" TagPrefix="Tfooter" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>
      Untitled Page
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
    </title>
  </head>

  <body>

    <form id="form1" runat="server">
      <div>

        <asp:Label ID="Label1" runat="server" Text="Welcome to ASP.Net Tutorials
"></asp:Label>
        <br />  <br />
        <asp:Button ID="Button1" runat="server" onclick="Button1_Click"  Text="Copyright
Info" />

      </div>
      <Tfooter:footer ID="footer1" runat="server" />
    </form>

  </body>
</html>
```

When executed, the page shows the footer and this control could be used in all the pages of your website.



Observe the following:

(1) The Register directive specifies a tag name as well as tag prefix for the control.

```
<%@ Register Src="~/footer.ascx" TagName="footer" TagPrefix="Tfooter" %>
```

(2) The following tag name and prefix should be used while adding the user control on the page:

```
<Tfooter:footer ID="footer1" runat="server" />
```

Custom Controls

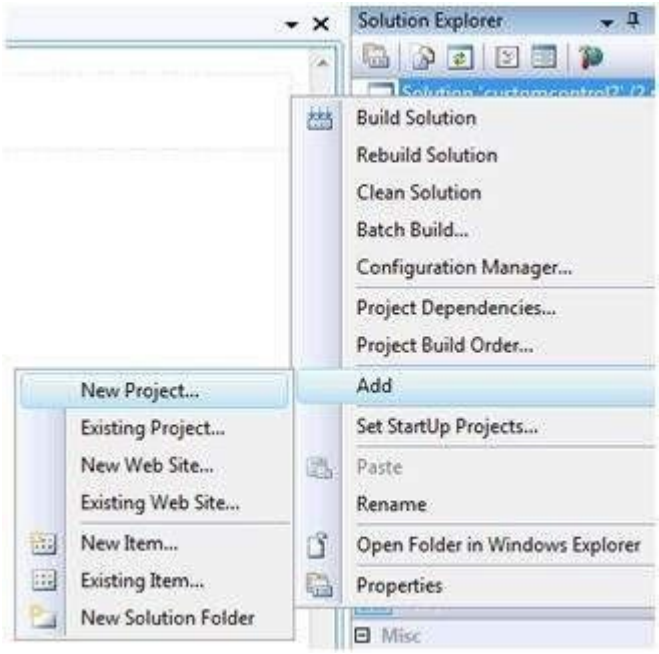
Custom controls are deployed as individual assemblies. They are compiled into a Dynamic Link Library (DLL) and used as any other ASP.NET server control. They could be created in either of the following way:

- By deriving a custom control from an existing control
- By composing a new custom control combing two or more existing controls.
- By deriving from the base control class.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

To understand the concept, let us create a custom control, which will simply render a text message on the browser. To create this control, take the following steps:

Create a new website. Right click the solution (not the project) at the top of the tree in the Solution Explorer.



In the New Project dialog box, select ASP.NET Server Control from the project templates.

The above step adds a new project and creates a complete custom control to the solution, called ServerControl1. In this example, let us name the project CustomControls. To use this control, this must be added as a reference to the web site before registering it on a page. To add a reference to the existing project, right click on the project (not the solution), and click Add Reference.

Select the CustomControls project from the Projects tab of the Add Reference dialog box. The Solution Explorer should show the reference.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

To use the control on a page, add the Register directive just below the @Page directive:

```
<%@ Register Assembly="CustomControls"  Namespace="CustomControls"  TagPrefix="ccs"
%>
```

Further, you can use the control, similar to any other controls.

```
<form id="form1" runat="server">
  <div>
    <ccs:ServerControl1 runat="server" Text = "I am a Custom Server Control" />
  </div>
</form>
```

When executed, the Text property of the control is rendered on the browser as shown:

Working with Custom Controls

In the previous example, the value for the Text property of the custom control was set. ASP.NET added this property by default, when the control was created. The following code behind file of the control reveals this.

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Linq;
using System.Text;

using System.Web;
using System.Web.UI;
using System.Web.UI.WebControls;

namespace CustomControls
{
  [DefaultProperty("Text")]
  [ToolboxData("<{0}:ServerControl1 runat=server></{0}:ServerControl1 >")]
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
public class ServerControl1 : WebControl
{
  [Bindable(true)]
  [Category("Appearance")]
  [DefaultValue("")]
  [Localizable(true)]

  public string Text
  {
    get
    {
      String s = (String)ViewState["Text"];
      return ((s == null) ? "[" + this.ID + "]" : s);
    }

    set
    {
      ViewState["Text"] = value;
    }
  }

  protected override void RenderContents(HtmlTextWriter output)
  {
    output.Write(Text);
  }
 }
}
```

The above code is automatically generated for a custom control. Events and methods could be added to the custom control class.

Example

Let us expand the previous custom control named SeverControl1. Let us give it a method named checkpalindrome, which gives it a power to check for palindromes.

Palindromes are words/literals that spell the same when reversed. For example, Malayalam, madam, saras, etc.

Extend the code for the custom control, which should look as:

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Linq;
using System.Text;

using System.Web;
using System.Web.UI;
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
using System.Web.UI.WebControls;

namespace CustomControls
{
  [DefaultProperty("Text")]
  [ToolboxData("<{0}:ServerControl1 runat=server></{0}:ServerControl1  >")]

  public class ServerControl1 : WebControl
  {
    [Bindable(true)]
    [Category("Appearance")]
    [DefaultValue("")]
    [Localizable(true)]

    public string Text
    {
      get
      {
        String s = (String)ViewState["Text"];
        return ((s == null) ? "[" + this.ID + "]" : s);
      }

      set
      {
        ViewState["Text"] = value;
      }
    }

    protected override void RenderContents(HtmlTextWriter output)
    {
      if (this.checkpanlindrome())
      {
        output.Write("This is a palindrome: <br />");
        output.Write("<FONT size=5 color=Blue>");
        output.Write("<B>");
        output.Write(Text);
        output.Write("</B>");
        output.Write("</FONT>");
      }
      else
      {
        output.Write("This is not a palindrome: <br />");
        output.Write("<FONT size=5 color=red>");
        output.Write("<B>");
        output.Write(Text);
        output.Write("</B>");
        output.Write("</FONT>");
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
        }
    }

    protected bool checkpanlindrome()
    {
      if (this.Text != null)
      {
        String str = this.Text;
        String strtoupper = Text.ToUpper();
        char[] rev = strtoupper.ToCharArray();
        Array.Reverse(rev);
        String strrev = new String(rev);

        if (strtoupper == strrev)
        {
          return true;
        }
        else
        {
          return false;
        }
      }
      else
      {
        return false;
      }
    }
  }
}
```

When you change the code for the control, you must build the solution by clicking Build --> Build Solution, so that the changes are reflected in your project. Add a text box and a button control to the page, so that the user can provide a text, it is checked for palindrome, when the button is clicked.

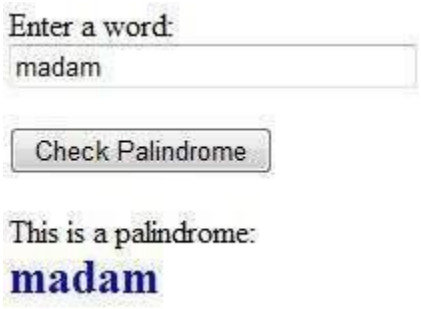
```
<form id="form1" runat="server">
  <div>
    Enter a word:
    <br />
    <asp:TextBox ID="TextBox1" runat="server" style="width:198px"> </asp:TextBox>

    <br /> <br />

    <asp:Button ID="Button1" runat="server onclick="Button1_Click" Text="Check
Palindrome" style="width:132px" />

    <br /> <br />
```

```
    <ccs:ServerControl1 ID="ServerControl11" runat="server" Text = "" />
  </div>
</form>
```

The Click event handler for the button simply copies the text from the text box to the text property of the custom control.

```
protected void Button1_Click(object sender, EventArgs e)
{
  this.ServerControl11.Text = this.TextBox1.Text;
}
```

When executed, the control successfully checks palindromes.



Observe the following:

(1) When you add a reference to the custom control, it is added to the toolbox and you can directly use it from the toolbox similar to any other control.

(2) The RenderContents method of the custom control class is overridden here, as you can add your own methods and events.

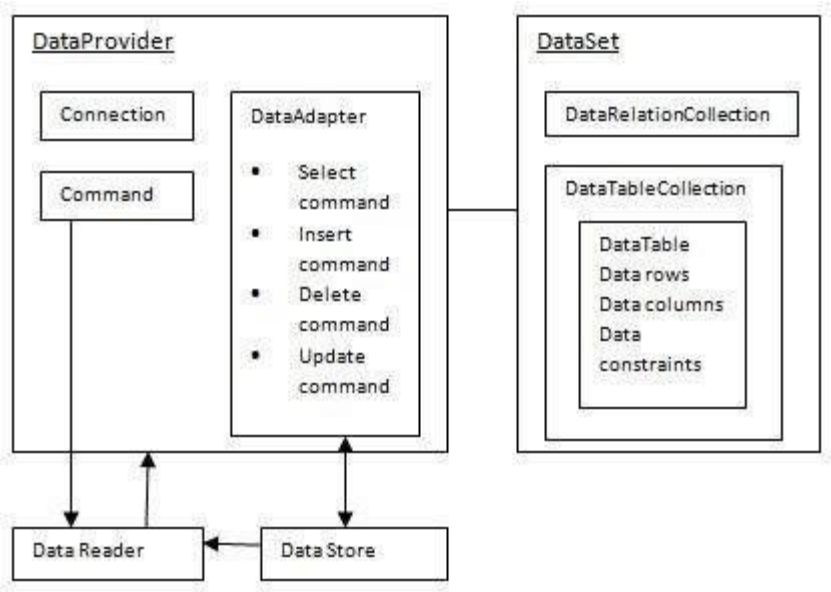
(3) The RenderContents method takes a parameter of HtmlTextWriter type, which is responsible for rendering on the browser.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ADO.NET

ADO.NET provides a bridge between the front end controls and the back end database. The ADO.NET objects encapsulate all the data access operations and the controls interact with these objects to display data, thus hiding the details of movement of data.

The following figure shows the ADO.NET objects at a glance:



The DataSet Class

The dataset represents a subset of the database. It does not have a continuous connection to the database. To update the database a reconnection is required. The DataSet contains DataTable objects and DataRelation objects. The DataRelation objects represent the relationship between two tables.

Following table shows some important properties of the DataSet class:

Properties	Description
CaseSensitive	Indicates whether string comparisons within the data tables are case-sensitive.
Container	Gets the container for the component.
DataSetName	Gets or sets the name of the current data set.
DefaultViewManager	Returns a view of data in the data set.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

DesignMode	Indicates whether the component is currently in design mode.
EnforceConstraints	Indicates whether constraint rules are followed when attempting any update operation.
Events	Gets the list of event handlers that are attached to this component.
ExtendedProperties	Gets the collection of customized user information associated with the DataSet.
HasErrors	Indicates if there are any errors.
IsInitialized	Indicates whether the DataSet is initialized.
Locale	Gets or sets the locale information used to compare strings within the table.
Namespace	Gets or sets the namespace of the DataSet.
Prefix	Gets or sets an XML prefix that aliases the namespace of the DataSet.
Relations	Returns the collection of DataRelation objects.
Tables	Returns the collection of DataTable objects.

The following table shows some important methods of the DataSet class:

Methods	Description
AcceptChanges	Accepts all changes made since the DataSet was loaded or this method was called.
BeginInit	Begins the initialization of the DataSet. The initialization occurs at run time.
Clear	Clears data.
Clone	Copies the structure of the DataSet, including all DataTable

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	schemas, relations, and constraints. Does not copy any data.
Copy	Copies both structure and data.
CreateDataReader()	Returns a DataTableReader with one result set per DataTable, in the same sequence as the tables appear in the Tables collection.
CreateDataReader(DataTable[])	Returns a DataTableReader with one result set per DataTable.
EndInit	Ends the initialization of the data set.
Equals(Object)	Determines whether the specified Object is equal to the current Object.
Finalize	Free resources and perform other cleanups.
GetChanges	Returns a copy of the DataSet with all changes made since it was loaded or the AcceptChanges method was called.
GetChanges(DataRowState)	Gets a copy of DataSet with all changes made since it was loaded or the AcceptChanges method was called, filtered by DataRowState.
GetDataSetSchema	Gets a copy of XmlSchemaSet for the DataSet.
GetObjectData	Populates a serialization information object with the data needed to serialize the DataSet.
GetType	Gets the type of the current instance.
GetXML	Returns the XML representation of the data.
GetXMLSchema	Returns the XSD schema for the XML representation of the

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

	data.
HasChanges()	Gets a value indicating whether the DataSet has changes, including new, deleted, or modified rows.
HasChanges(DataRowState)	Gets a value indicating whether the DataSet has changes, including new, deleted, or modified rows, filtered by DataRowState.
IsBinarySerialized	Inspects the format of the serialized representation of the DataSet.
Load(IDataReader, LoadOption, DataTable[])	Fills a DataSet with values from a data source using the supplied IDataReader, using an array of DataTable instances to supply the schema and namespace information.
Load(IDataReader, LoadOption, String[])	Fills a DataSet with values from a data source using the supplied IDataReader, using an array of strings to supply the names for the tables within the DataSet.
Merge()	Merges the data with data from another DataSet. This method has different overloaded forms.
ReadXML()	Reads an XML schema and data into the DataSet. This method has different overloaded forms.
ReadXMLSchema(0)	Reads an XML schema into the DataSet. This method has different overloaded forms.
RejectChanges	Rolls back all changes made since the last call to AcceptChanges.
WriteXML()	Writes an XML schema and data from the DataSet. This method has different overloaded forms.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

WriteXMLSchema()	Writes the structure of the DataSet as an XML schema. This method has different overloaded forms.

The DataTable Class

The DataTable class represents the tables in the database. It has the following important properties; most of these properties are read only properties except the PrimaryKey property:

Properties	Description
ChildRelations	Returns the collection of child relationship.
Columns	Returns the Columns collection.
Constraints	Returns the Constraints collection.
DataSet	Returns the parent DataSet.
DefaultView	Returns a view of the table.
ParentRelations	Returns the ParentRelations collection.
PrimaryKey	Gets or sets an array of columns as the primary key for the table.
Rows	Returns the Rows collection.

The following table shows some important methods of the DataTable class:

Methods	Description
AcceptChanges	Commits all changes since the last AcceptChanges.
Clear	Clears all data from the table.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

GetChanges	Returns a copy of the DataTable with all changes made since the AcceptChanges method was called.
GetErrors	Returns an array of rows with errors.
ImportRows	Copies a new row into the table.
LoadDataRow	Finds and updates a specific row, or creates a new one, if not found any.
Merge	Merges the table with another DataTable.
NewRow	Creates a new DataRow.
RejectChanges	Rolls back all changes made since the last call to AcceptChanges.
Reset	Resets the table to its original state.
Select	Returns an array of DataRow objects.

The DataRow Class

The DataRow object represents a row in a table. It has the following important properties:

Properties	Description
HasErrors	Indicates if there are any errors.
Items	Gets or sets the data stored in a specific column.
ItemArrays	Gets or sets all the values for the row.
Table	Returns the parent table.

The following table shows some important methods of the DataRow class:

Methods	Description
AcceptChanges	Accepts all changes made since this method was called.
BeginEdit	Begins edit operation.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

CancelEdit	Cancels edit operation.
Delete	Deletes the DataRow.
EndEdit	Ends the edit operation.
GetChildRows	Gets the child rows of this row.
GetParentRow	Gets the parent row.
GetParentRows	Gets parent rows of DataRow object.
RejectChanges	Rolls back all changes made since the last call to

The DataAdapter Object

The DataAdapter object acts as a mediator between the DataSet object and the database. This helps the Dataset to contain data from multiple databases or other data source.

The DataReader Object

The DataReader object is an alternative to the DataSet and DataAdapter combination. This object provides a connection oriented access to the data records in the database. These objects are suitable for read-only access, such as populating a list and then breaking the connection.

DbCommand and DbConnection Objects

The DbConnection object represents a connection to the data source. The connection could be shared among different command objects.

The DbCommand object represents the command or a stored procedure sent to the database from retrieving or manipulating data.

Example

So far, we have used tables and databases already existing in our computer. In this example, we will create a table, add column, rows and data into it and display the table using a GridView object.

The source file code is as given:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
Inherits="createdatabase._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>
      Untitled Page
    </title>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
  </head>

  <body>
    <form id="form1" runat="server">

      <div>
        <asp:GridView ID="GridView1" runat="server">
        </asp:GridView>
      </div>

    </form>
  </body>

</html>
```

The code behind file is as given:

```
namespace createdatabase
{
  public partial class _Default : System.Web.UI.Page
  {
    protected void Page_Load(object sender, EventArgs e)
    {
      if (!IsPostBack)
      {
        DataSet ds = CreateDataSet();
        GridView1.DataSource = ds.Tables["Student"];
        GridView1.DataBind();
      }
    }

    private DataSet CreateDataSet()
    {
      //creating a DataSet object for tables
      DataSet dataset = new DataSet();

      // creating the student table
      DataTable Students = CreateStudentTable();
      dataset.Tables.Add(Students);
      return dataset;
    }

    private DataTable CreateStudentTable()
    {
      DataTable Students = new DataTable("Student");

      // adding columns
      AddNewColumn(Students, "System.Int32", "StudentID");
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

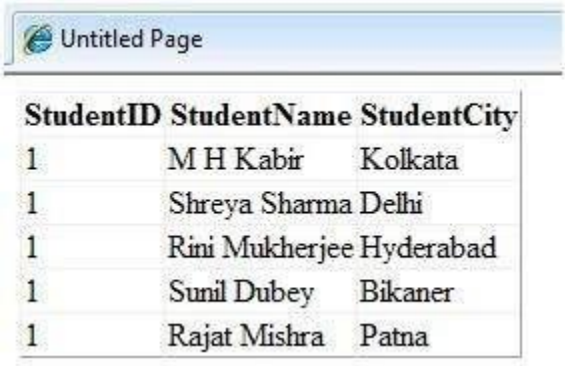
```
        AddNewColumn(Students, "System.String", "StudentName");
        AddNewColumn(Students, "System.String", "StudentCity");

        // adding rows
        AddNewRow(Students, 1, "M H Kabir", "Kolkata");
        AddNewRow(Students, 1, "Shreya Sharma", "Delhi");
        AddNewRow(Students, 1, "Rini Mukherjee", "Hyderabad");
        AddNewRow(Students, 1, "Sunil Dubey", "Bikaner");
        AddNewRow(Students, 1, "Rajat Mishra", "Patna");

        return Students;
    }

    private void AddNewColumn(DataTable table, string columnType, string  columnName)
    {
        DataColumn column = table.Columns.Add(columnName,  Type.GetType(columnType));
    }

    //adding data into the table
    private void AddNewRow(DataTable table, int id, string name, string city)
    {
        DataRow newrow = table.NewRow();
        newrow["StudentID"] = id;
        newrow["StudentName"] = name;
        newrow["StudentCity"] = city;
        table.Rows.Add(newrow);
    }
  }
}
```

When you execute the program, observe the following:

- The application first creates a data set and binds it with the grid view control using the DataBind() method of the GridView control.
- The Createdataset() method is a user defined function, which creates a new DataSet object and then calls another user defined method CreateStudentTable() to create the table and add it to the Tables collection of the data set.
- The CreateStudentTable() method calls the user defined methods AddNewColumn() and AddNewRow() to create the columns and rows of the table as well as to add data to the rows.

When the page is executed, it returns the rows of the table as shown:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en



StudentID	StudentName	StudentCity
1	M H Kabir	Kolkata
1	Shreya Sharma	Delhi
1	Rini Mukherjee	Hyderabad
1	Sunil Dubey	Bikaner
1	Rajat Mishra	Patna

ASP.NET - Error Handling

Error handling in ASP.NET has three aspects:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

- **Tracing** - tracing the program execution at page level or application level.
- **Error handling** - handling standard errors or custom errors at page level or application level.
- **Debugging** - stepping through the program, setting break points to analyze the code

In this chapter, we will discuss tracing and error handling and in this chapter, we will discuss debugging.

To understand the concepts, create the following sample application. It has a label control, a dropdown list, and a link. The dropdown list loads an array list of famous quotes and the selected quote is shown in the label below. It also has a hyperlink which has points to a nonexistent link.

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
Inherits="errorhandling._Default" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >

  <head runat="server">
    <title>
      Tracing, debugging and error handling
    </title>
  </head>

  <body>
    <form id="form1" runat="server">

      <div>
        <asp:Label ID="lblheading" runat="server" Text="Tracing, Debuggin  and Error
Handling">
        </asp:Label>

        <br /> <br />

        <asp:DropDownList ID="ddlquotes" runat="server" AutoPostBack="True"
onselectedindexchanged="ddlquotes_SelectedIndexChanged">
        </asp:DropDownList>

        <br /> <br />

        <asp:Label ID="lblquotes" runat="server">
        </asp:Label>

        <br /> <br />

        <asp:HyperLink ID="HyperLink1" runat="server" NavigateUrl="mylink.htm">Link
to:</asp:HyperLink>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
      </div>

    </form>
  </body>

</html>
```

The code behind file:

```
public partial class _Default : System.Web.UI.Page
{
  protected void Page_Load(object sender, EventArgs e)
  {
    if (!IsPostBack)
    {
      string[,] quotes =
      {
        {"Imagination is more important than Knowledge.", "Albert Einsten"},
        {"Assume a virtue, if you have it not" "Shakespeare"},
        {"A man cannot be comfortable without his own approval", "Mark Twain"},
        {"Beware the young doctor and the old barber", "Benjamin Franklin"},
        {"Whatever begun in anger ends in shame", "Benjamin Franklin"}
      };

      for (int i=0; i<quotes.GetLength(0); i++)
        ddlquotes.Items.Add(new ListItem(quotes[i,0], quotes[i,1]));
    }
  }

  protected void ddlquotes_SelectedIndexChanged(object sender, EventArgs e)
  {
    if (ddlquotes.SelectedIndex != -1)
    {
      lblquotes.Text = String.Format("{0}, Quote: {1}", ddlquotes.SelectedItem.Text,
ddlquotes.SelectedValue);
    }
  }
}
```

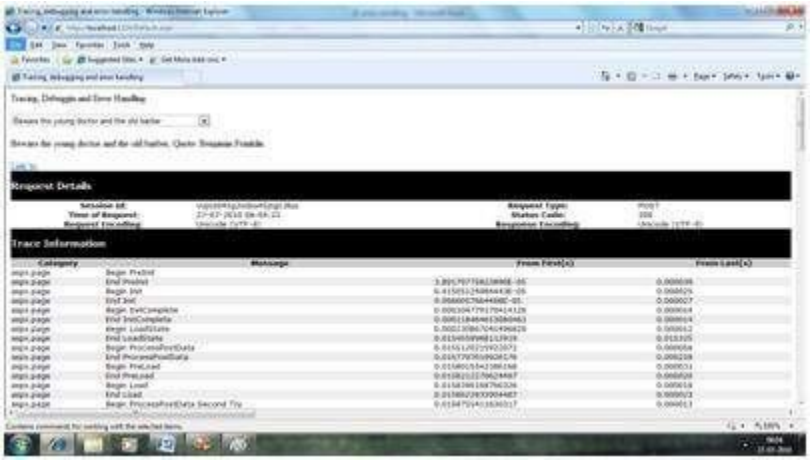
Tracing

To enable page level tracing, you need to modify the Page directive and add a Trace attribute as shown:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
  Inherits="errorhandling._Default" Trace ="true" %>
```

Now when you execute the file, you get the tracing information:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en



It provides the following information at the top:

- Session ID
- Status Code
- Time of Request
- Type of Request
- Request and Response Encoding

The status code sent from the server, each time the page is requested shows the name and time of error if any. The following table shows the common HTTP status codes:

Number	Description
Informational (100 - 199)	
100	Continue
101	Switching protocols
Successful (200 - 299)	
200	OK
204	No content
Redirection (300 - 399)	
301	Moved permanently
305	Use proxy
307	Temporary redirect
Client Errors (400 - 499)	
400	Bad request
402	Payment required
404	Not found

408	Request timeout
417	Expectation failed
Server Errors (500 - 599)	
500	Internal server error
503	Service unavailable
505	HTTP version not supported

Under the top level information, there is Trace log, which provides details of page life cycle. It provides elapsed time in seconds since the page was initialized.

Trace Information

Category	
aspx.page	Begin PreInit
aspx.page	End PreInit
aspx.page	Begin Init
aspx.page	End Init
aspx.page	Begin InitComplete
aspx.page	End InitComplete
aspx.page	Begin LoadState
aspx.page	End LoadState
aspx.page	Begin ProcessPostData
aspx.page	End ProcessPostData
aspx.page	Begin PreLoad
aspx.page	End PreLoad
aspx.page	Begin Load
aspx.page	End Load
aspx.page	Begin ProcessPostData Second Try
aspx.page	End ProcessPostData Second Try
aspx.page	Begin Raise ChangedEvents
aspx.page	End Raise ChangedEvents

The next section is control tree, which lists all controls on the page in a hierarchical manner:

Control Tree

Control UniqueID	Type	Render Size
__Page	ASP.default_aspx	2850
ctl02	System.Web.UI.LiteralControl	175
ctl00	System.Web.UI.HtmlControls.HtmlHead	70
ctl01	System.Web.UI.HtmlControls.HtmlTitle	57
ctl03	System.Web.UI.LiteralControl	14
form1	System.Web.UI.HtmlControls.HtmlForm	2571
ctl04	System.Web.UI.LiteralControl	27
lblheading	System.Web.UI.WebControls.Label	65
ctl05	System.Web.UI.LiteralControl	42
ddlquotes	System.Web.UI.WebControls.DropDownList	570
ctl06	System.Web.UI.LiteralControl	42
lblquotes	System.Web.UI.WebControls.Label	96
ctl07	System.Web.UI.LiteralControl	42
HyperLink1	System.Web.UI.WebControls.HyperLink	49
ctl08	System.Web.UI.LiteralControl	24
ctl09	System.Web.UI.LiteralControl	20

Last in the Session and Application state summaries, cookies, and headers collections followed by list of all server variables.

The Trace object allows you to add custom information to the trace output. It has two methods to accomplish this: the Write method and the Warn method.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Change the Page_Load event handler to check the Write method:

```
protected void Page_Load(object sender, EventArgs e)
{
  Trace.Write("Page Load");

  if (!IsPostBack)
  {
    Trace.Write("Not Post Back, Page Load");
    string[,] quotes =
    ......................
  }
}
```

Run to observe the effects:

```
aspx.page        Begin PreLoad
aspx.page        End PreLoad
aspx.page        Begin Load
                 Page Load
                 Not Post Back, Page Load
aspx.page        End Load
aspx.page        Begin LoadComplete
aspx.page        End LoadComplete
```

To check the Warn method, let us forcibly enter some erroneous code in the selected index changed event handler:

```
try
{
  int a =  0;
  int b = 9 / a;
}catch (Exception e)
{
  Trace.Warn("UserAction", "processing 9/a", e);
}
```

Try-Catch is a C# programming construct. The try block holds any code that may or may not produce error and the catch block catches the error. When the program is run, it sends the warning in the trace log.

```
aspx.page Begin Raise ChangedEvents
          processing 9/a
UserAction Attempted to divide by zero.
           at errorhandling._Default.ddlquotes_SelectedIndexChanged(Object sender, EventArgs e) in
```

Application level tracing applies to all the pages in the web site. It is implemented by putting the following code lines in the web.config file:

```
<system.web>
  <trace enabled="true" />
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
</system.web>
```

Error Handling

Although ASP.NET can detect all runtime errors, still some subtle errors may still be there. Observing the errors by tracing is meant for the developers, not for the users.

Hence, to intercept such occurrence, you can add error handing settings in the web.config file of the application. It is application-wide error handling. For example, you can add the following lines in the web.config file:

```
<configuration>
  <system.web>

    <customErrors mode="RemoteOnly" defaultRedirect="GenericErrorPage.htm">
      <error statusCode="403" redirect="NoAccess.htm"/>
      <error statusCode="404" redirect="FileNotFound.htm" />
    </customErrors>

  </system.web>
<configuration>
```

The <customErrors> section has the possible attributes:

- **Mode** : It enables or disables custom error pages. It has the three possible values:
  - **On** : displays the custom pages.
  - **Off** : displays ASP.NET error pages (yellow pages)
  - **remoteOnly** : It displays custom errors to client, display ASP.NET errors locally.
- **defaultRedirect** : It contains the URL of the page to be displayed in case of unhandled errors.

To put different custom error pages for different type of errors, the <error> sub tags are used, where different error pages are specified, based on the status code of the errors.

To implement page level error handling, the Page directive could be modified:

```
<%@ Page Language="C#" AutoEventWireup="true" CodeBehind="Default.aspx.cs"
  Inherits="errorhandling._Default" Trace ="true" ErrorPage="PageError.htm" %>
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ASP.NET – Security

Implementing security in a site has the following aspects:

- **Authentication** : It is the process of ensuring the user's identity and authenticity. ASP.NET allows four types of authentications:
    - Windows Authentication
    - Forms Authentication
    - Passport Authentication
    - Custom Authentication
- **Authorization** : It is the process of defining and allotting specific roles to specific users.
- **Confidentiality** : It involves encrypting the channel between the client browser and the web server.
- **Integrity** : It involves maintaining the integrity of data. For example, implementing digital signature.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Forms-Based Authentication

Traditionally, forms-based authentication involves editing the web.config file and adding a login page with appropriate authentication code.

The web.config file could be edited and the following codes written on it:

```
<configuration>

<system.web>
  <authentication mode="Forms">
    <forms loginUrl ="login.aspx"/>
  </authentication>

  <authorization>
    <deny users="?"/>
  </authorization>
</system.web>
...
...
</configuration>
```

The login.aspx page mentioned in the above code snippet could have the following code behind file with the usernames and passwords for authentication hard coded into it.

```
protected bool authenticate(String uname, String pass)
{
  if(uname == "Tom")
  {
    if(pass == "tom123")
      return true;
  }

  if(uname == "Dick")
  {
    if(pass == "dick123")
      return true;
  }

  if(uname == "Harry")
  {
    if(pass == "har123")
      return true;
  }

  return false;
}

public void OnLogin(Object src, EventArgs e)
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
{
  if (authenticate(txtuser.Text, txtpwd.Text))
  {
    FormsAuthentication.RedirectFromLoginPage(txtuser.Text, chkrem.Checked);
  }
  else
  {
    Response.Write("Invalid user name or password");
  }
}
```

Observe that the FormsAuthentication class is responsible for the process of authentication.

However, Visual Studio allows you to implement user creation, authentication, and authorization with seamless ease without writing any code, through the Web Site Administration tool. This tool allows creating users and roles.

Apart from this, ASP.NET comes with readymade login controls set, which has controls performing all the jobs for you.

Implementing Forms-Based Security

To set up forms-based authentication, you need the following:

- A database of users to support the authentication process
- A website that uses the database
- User accounts
- Roles
- Restriction of users and group activities
- A default page, to display the login status of the users and other information.
- A login page, to allow users to log in, retrieve password, or change password

To create users, take the following steps:

Step (1) : Choose Website -> ASP.NET Configuration to open the Web Application Administration Tool.

Step (2) : Click on the Security tab.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

ASP.net Web Site Administration Tool
Home
Security
Application
Provider
You can use the Web Site Administration Tool to manage all the security settings for your application. You can set up users and passwords (authentication), create roles (groups of users), and create permissions (rules for controlling access to parts of your application).
By default, user information is stored in a Microsoft SQL Server Express database in the Data folder of your Web site. If you want to store user information in a different database, use the Provider tab to select a different provider.
Use the security Setup Wizard to configure security step by step.
Click the links in the table to manage the settings for your application.
Users
Existing users: 4
Create user
Manage users
Select authentication type
Roles
Existing roles: 2
Disable Roles
Create or Manage roles
Access Rules
Create access rules
Manage access rules

Step (3) : Select the authentication type to 'Forms based authentication' by selecting the 'From the Internet' radio button.

ASP.net Web Site Administration Tool
Home
Security
Application
Provider
How will users access your site?
From the internet
Select this option if users will access your web site from the public internet. Users will be required to log on using a web form. The site will use forms authentication to identify users according to user information that you store in a database.
From a local network
Select this option if users will access your web site only from a private local network. The site will use built-in Microsoft Windows authentication to identify users. Users with a valid Windows user name and password will be able to access your site.

Step (4) : Click on 'Create Users' link to create some users. If you already had created roles, you could assign roles to the user, right at this stage.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Step (5) : Create a web site and add the following pages:

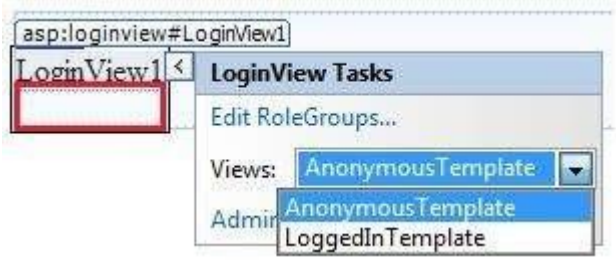
- Welcome.aspx
- Login.aspx
- CreateAccount.aspx
- PasswordRecovery.aspx
- ChangePassword.aspx

Step (6) : Place a LoginStatus control on the Welcome.aspx from the login section of the toolbox. It has two templates: LoggedIn and LoggedOut.

In LoggedOut template, there is a login link and in the LoggedIn template, there is a logout link on the control. You can change the login and logout text properties of the control from the Properties window.

Step (7) : Place a LoginView control from the toolbox below the LoginStatus control. Here, you can put texts and other controls (hyperlinks, buttons etc.), which are displayed based on whether the user is logged in or not.

This control has two view templates: Anonymous template and LoggedIn template. Select each view and write some text for the users to be displayed for each template. The text should be placed on the area marked red.



Step (8) : The users for the application are created by the developer. You might want to allow a visitor to create a user account. For this, add a link beneath the LoginView control, which should link to the CreateAccount.aspx page.

Step (9) : Place a CreateUserWizard control on the create account page. Set the ContinueDestinationPageUrl property of this control to Welcome.aspx.

Step (10) : Create the Login page. Place a Login control on the page. The LoginStatus control automatically links to the Login.aspx. To change this default, make the following changes in the web.config file.

For example, if you want to name your log in page as signup.aspx, add the following lines to the <authentication> section of the web.config:

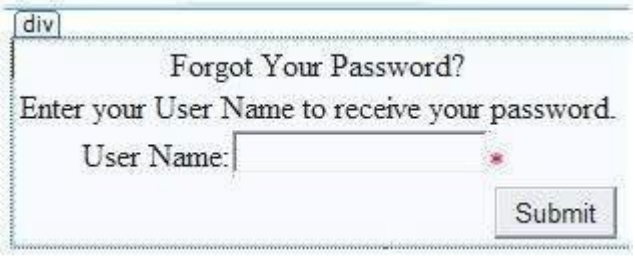
```
<configuration>
  <system.web>
    <authentication mode="Forms">
      <forms loginUrl ="signup.aspx" defaultUrl = â€œWelcome.aspxâ€ • />
    </authentication>
  </system.web>
</configuration>
```

Step (11) : Users often forget passwords. The PasswordRecovery control helps the user gain access to the account. Select the Login control. Open its smart tag and click 'Convert to Template'.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

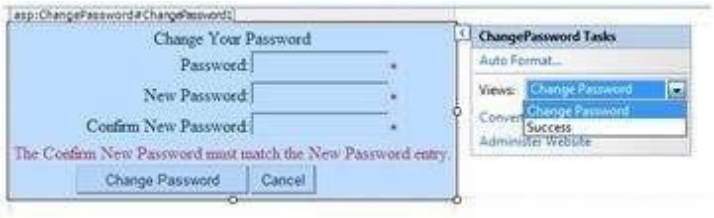
Customize the UI of the control to place a hyperlink control under the login button, which should link to the PassWordRecovery.aspx.

Step (12) : Place a PasswordRecovery control on the password recovery page. This control needs an email server to send the passwords to the users.



Step (13) : Create a link to the ChangePassword.aspx page in the LoggedIn template of the LoginView control in Welcome.aspx.

Step (14) : Place a ChangePassword control on the change password page. This control also has two views.

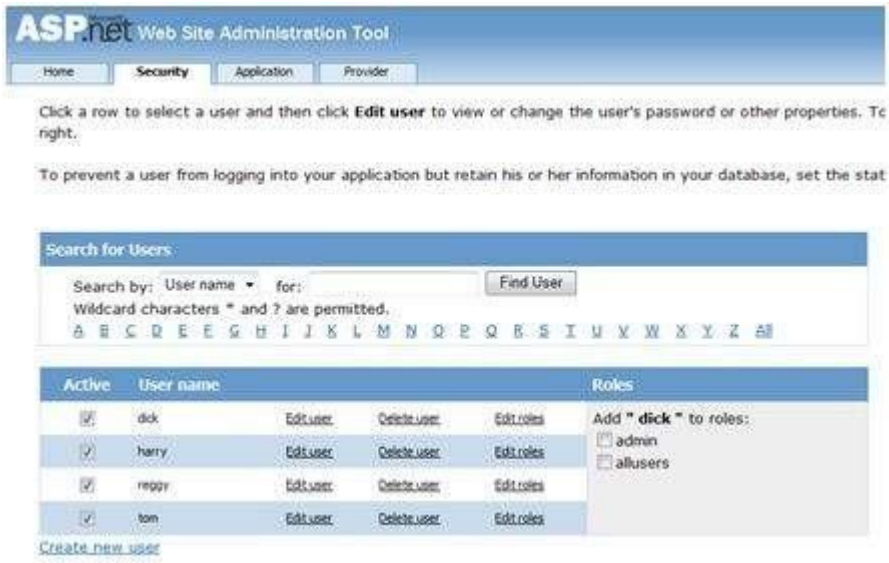


Now run the application and observe different security operations.

To create roles, go back to the Web Application Administration Tools and click on the Security tab. Click on 'Create Roles' and create some roles for the application.

ASP.net Web Site Administration Tool
Home
Security
Application
Provider
You can optionally add roles, or groups, that enable you to allow or deny groups of users access to specific folders in your Web site. For example, you might create roles such as "managers," "sales," or "members," each with different access to specific folders.
Create New Role
New role name:
Add Role
Role Name
Add/Remove Users
admin
Manage
Delete
allusers
Manage
Delete

Click on the 'Manage Users' link and assign roles to the users.



IIS Authentication: SSL

The Secure Socket Layer or SSL is the protocol used to ensure a secure connection. With SSL enabled, the browser encrypts all data sent to the server and decrypts all data coming from the server. At the same time, the server encrypts and decrypts all data to and from browser.

The URL for a secure connection starts with HTTPS instead of HTTP. A small lock is displayed by a browser using a secure connection. When a browser makes an initial attempt to

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

communicate with a server over a secure connection using SSL, the server authenticates itself by sending its digital certificate.

To use the SSL, you need to buy a digital secure certificate from a trusted Certification Authority (CA) and install it in the web server. Following are some of the trusted and reputed certification authorities:

- www.verisign.com
- www.geotrust.com
- www.thawte.com

SSL is built into all major browsers and servers. To enable SSL, you need to install the digital certificate. The strength of various digital certificates varies depending upon the length of the key generated during encryption. More the length, more secure is the certificate, hence the connection.

Strength	Description
40 bit	Supported by most browsers but easy to break.
56 bit	Stronger than 40-bit.
128 bit	Extremely difficult to break but all the browsers do not support it.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

What is Caching?

Caching is a technique of storing frequently used data/information in memory, so that, when the same data/information is needed next time, it could be directly retrieved from the memory instead of being generated by the application.

Caching is extremely important for performance boosting in ASP.NET, as the pages and controls are dynamically generated here. It is especially important for data related transactions, as these are expensive in terms of response time.

Caching places frequently used data in quickly accessed media such as the random access memory of the computer. The ASP.NET runtime includes a key-value map of CLR objectscalled cache. This resides with the application and is available via the HttpContext and System.Web.UI.Page.

In some respect, caching is similar to storing the state objects. However, the storing information in state objects is deterministic, i.e., you can count on the data being stored there, and caching of data is nondeterministic.

The data will not be available in the following cases:

- If its lifetime expires,
- If the application releases its memory,
- If caching does not take place for some reason.

You can access items in the cache using an indexer and may control the lifetime of objects in the cache and set up links between the cached objects and their physical sources.

Caching in ASP.Net

ASP.NET provides the following different types of caching:

- **Output Caching** : Output cache stores a copy of the finally rendered HTML pages or part of pages sent to the client. When the next client requests for this page, instead of regenerating the page, a cached copy of the page is sent, thus saving time.
- **Data Caching** : Data caching means caching data from a data source. As long as the cache is not expired, a request for the data will be fulfilled from the cache. When the cache is expired, fresh data is obtained by the data source and the cache is refilled.
- **Object Caching** : Object caching is caching the objects on a page, such as data-bound controls. The cached data is stored in server memory.
- **Class Caching** : Web pages or web services are compiled into a page class in theassembly, when run for the first time. Then the assembly is cached in the server. Next time when a request is made for the page or service, the cached assembly is referred to. When the source code is changed, the CLR recompiles the assembly.
- **Configuration Caching** : Application wide configuration information is stored in a configuration file. Configuration caching stores the configuration information in the server memory.

Now, we will consider output caching, data caching, and object caching.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

Output Caching

Rendering a page may involve some complex processes such as, database access, rendering complex controls etc. Output caching allows bypassing the round trips to server by caching data in memory. Even the whole page could be cached.

The OutputCache directive is responsible of output caching. It enables output caching and provides certain control over its behaviour.

Syntax for OutputCache directive:

```
<%@ OutputCache Duration="15" VaryByParam="None" %>
```

Put this directive under the page directive. This tells the environment to cache the page for 15 seconds. The following event handler for page load would help in testing that the page was really cached.

```
protected void Page_Load(object sender, EventArgs e)
{
  Thread.Sleep(10000);
  Response.Write("This page was generated and cache at:" +
  DateTime.Now.ToString());
}
```

The **Thread.Sleep()** method stops the process thread for the specified time. In this example, the thread is stopped for 10 seconds, so when the page is loaded for first time, it takes 10 seconds. However, next time you refresh the page it does not take any time, as the page is retrieved from the cache without being loaded.

The OutputCache directive has the following attributes, which helps in controlling the behaviour of the output cache:

Attribute	Values	Description
DiskCacheable	true/false	Specifies that output could be written to a disk based cache.
NoStore	true/false	Specifies that the "no store" cache control header is sent or not.
CacheProfile	String name	Name of a cache profile as to be stored in web.config.
VaryByParam	None * Param- name	Semicolon delimited list of string specifies query string values in a GET request or variable in a POST request.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

VaryByHeader	* Header names	Semicolon delimited list of strings specifies headers that might be submitted by a client.
VaryByCustom	Browser Custom string	Tells ASP.NET to vary the output cache by browser name and version or by a custom string.
Location	Any Client Downstream Server None	Any: page may be cached anywhere. Client: cached content remains at browser. Downstream: cached content stored in downstream and server both. Server: cached content saved only on server. None: disables caching.
Duration	Number	Number of seconds the page or control is cached.

Let us add a text box and a button to the previous example and add this event handler for the button.

```
protected void btnmagic_Click(object sender, EventArgs e)
{
  Response.Write("<br><br>");
  Response.Write("<h2> Hello, " + this.txtname.Text + "</h2>");
}
```

Change the OutputCache directive:

```
<%@ OutputCache Duration="60" VaryByParam="txtname" %>
```

When the program is executed, ASP.NET caches the page on the basis of the name in the text box.

Data Caching

The main aspect of data caching is caching the data source controls. We have already discussed that the data source controls represent data in a data source, like a database or an XML file. These controls derive from the abstract class DataSourceControl and have the following inherited properties for implementing caching:

- **CacheDuration** - It sets the number of seconds for which the data source will cache data.

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

- **CacheExpirationPolicy** - It defines the cache behavior when the data in cache has expired.
- **CacheKeyDependency** - It identifies a key for the controls that auto-expires the content of its cache when removed.
- **EnableCaching** - It specifies whether or not to cache the data.

Example

To demonstrate data caching, create a new website and add a new web form on it. Add a SqlDataSource control with the database connection already used in the data access tutorials.

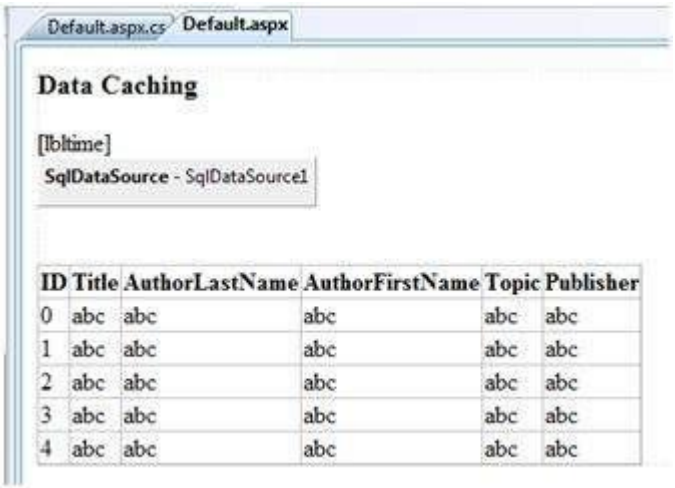
For this example, add a label to the page, which would show the response time for the page.

```
<asp:Label ID="lbltime" runat="server"></asp:Label>
```

Apart from the label, the content page is same as in the data access tutorial. Add an event handler for the page load event:

```
protected void Page_Load(object sender, EventArgs e)
{
  lbltime.Text = String.Format("Page posted at: {0}", DateTime.Now.ToLongTimeString());
}
```

The designed page should look as shown:



ID	Title	AuthorLastName	AuthorFirstName	Topic	Publisher
0	abc	abc	abc	abc	abc
1	abc	abc	abc	abc	abc
2	abc	abc	abc	abc	abc
3	abc	abc	abc	abc	abc
4	abc	abc	abc	abc	abc

When you execute the page for the first time, nothing different happens, the label shows that, each time you refresh the page, the page is reloaded and the time shown on the label changes.

Next, set the EnableCaching attribute of the data source control to be 'true' and set the Cacheduration attribute to '60'. It will implement caching and the cache will expire every 60 seconds.

The timestamp changes with every refresh, but if you change the data in the table within these 60 seconds, it is not shown before the cache expires.

```
<asp:SqlDataSource ID = "SqlDataSource1" runat = "server"
  ConnectionString = "<%$ ConnectionStrings: ASPDotNetStepByStepConnectionString %>"
```

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
  ProviderName = "<%$ ConnectionStrings:
ASPDotNetStepByStepConnectionString.ProviderName %>"
  SelectCommand = "SELECT * FROM [DotNetReferences]"
  EnableCaching = "true" CacheDuration = "60">
</asp:SqlDataSource>
```

Object Caching

Object caching provides more flexibility than other cache techniques. You can use object caching to place any object in the cache. The object can be of any type - a data type, a web control, a class, a dataset object, etc. The item is added to the cache simply by assigning a new key name, shown as follows Like:

```
Cache["key"] = item;
```

ASP.NET also provides the Insert() method for inserting an object to the cache. This method has four overloaded versions. Let us see them:

Overload	Description
Cache.Insert((key, value);	Inserts an item into the cache with the key name and value with default priority and expiration.
Cache.Insert(key, value, dependencies);	Inserts an item into the cache with key, value, default priority, expiration and a CacheDependency name that links to other files or items so that when these change the cache item remains no longer valid.
Cache.Insert(key, value, dependencies, absoluteExpiration, slidingExpiration);	This indicates an expiration policy along with the above issues.
Cache.Insert(key, value, dependencies, absoluteExpiration, slidingExpiration, priority, onRemoveCallback);	This along with the parameters also allows you to set a priority for the cache item and a delegate that, points to a method to be invoked when the item is removed.

Sliding expiration is used to remove an item from the cache when it is not used for the specified time span. The following code snippet stores an item with a sliding expiration of 10 minutes with no dependencies.

```
Cache.Insert("my_item", obj, null, DateTime.MaxValue, TimeSpan.FromMinutes(10));
```

Example

Create a page with just a button and a label. Write the following code in the page load event:

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

```
protected void Page_Load(object sender, EventArgs e)
{
  if (this.IsPostBack)
  {
    lblinfo.Text += "Page Posted Back.<br/>";
  }
  else
  {
    lblinfo.Text += "page Created.<br/>";
  }

  if (Cache["testitem"] == null)
  {
    lblinfo.Text += "Creating test item.<br/>";
    DateTime testItem = DateTime.Now;
    lblinfo.Text += "Storing test item in cache ";
    lblinfo.Text += "for 30 seconds.<br/>";
    Cache.Insert("testitem", testItem, null,
    DateTime.Now.AddSeconds(30), TimeSpan.Zero);
  }
  else
  {
    lblinfo.Text += "Retrieving test item.<br/>";
    DateTime testItem = (DateTime)Cache["testitem"];
    lblinfo.Text += "Test item is: " + testItem.ToString();
    lblinfo.Text += "<br/>";
  }

  lblinfo.Text += "<br/>";
}
```

When the page is loaded for the first time, it says:

Page Created.
Creating test item.
Storing test item in cache for 30 seconds.

If you click on the button again within 30 seconds, the page is posted back but the label control gets its information from the cache as shown:

Page Posted Back.
Retrieving test item.
Test item is: 14-07-2010 01:25:04

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

References

1. *Kamal Acharya. School management system project report. Authorea. August 01, 2024. DOI: https://doi.org/10.22541/au.172254873.34023165/v1*
2. *Kamal Acharya. A CASE STUDY OF CINEMA MANAGEMENT SYSTEM PROJECT. Authorea. August 01, 2024. DOI: https://doi.org/10.22541/au.172254873.30191075/v1*
3. *Kamal Acharya. A CASE STUDY ON ONLINE TICKET BOOKING SYSTEM PROJECT. Authorea. August 01, 2024. DOI: https://doi.org/10.22541/au.172254872.26972790/v1*
4. *Kamal Acharya. Web chatting application project report management system. Authorea. August 01, 2024. DOI: https://doi.org/10.22541/au.172254871.18588592/v1*
5. *Kamal Acharya. RETAIL STORE MANAGEMENT SYSTEM PROJECT REPORT. Authorea. August 01, 2024. DOI: https://doi.org/10.22541/au.172254871.14590154/v1*
6. *Kamal Acharya. SUPERMARKET MANAGEMENT SYSTEM PROJECT REPORT. Authorea. August 01, 2024. DOI: https://doi.org/10.22541/au.172252491.19145062/v1*
7. *Kamal Acharya. SOCIAL MEDIA MANAGEMENT SYSTEM PROJECT REPORT. Authorea. August 01, 2024. DOI: https://doi.org/10.22541/au.172252491.11210579/v1*
8. *Kamal Acharya. Online music portal management system project report. Authorea. August 01, 2024. DOI: https://doi.org/10.22541/au.172252488.89734698/v1*
9. *Kamal Acharya. COLLEGE BUS MANAGEMENT SYSTEM PROJECT REPORT. Authorea. July 31, 2024. DOI: https://doi.org/10.22541/au.172245277.70798942/v1*
10. *Kamal Acharya. AUTOMOBILE MANAGEMENT SYSTEM PROJECT REPORT. Authorea. July 31, 2024. DOI: https://doi.org/10.22541/au.172245276.67982593/v1*
11. *Kamal Acharya. Ludo management system project report. Authorea. July 31, 2024.DOI: https://doi.org/10.22541/au.172243999.98091616/v1*
12. *Kamal Acharya. Literature online quiz system project report. Authorea. July 31, 2024. DOI: https://doi.org/10.22541/au.172243825.53562953/v1*
13. *Kamal Acharya. Avoid waste management system project. Authorea. July 29, 2024. DOI: https://doi.org/10.22541/au.172228528.85022205/v1*

Visit researchgate Profile : https://www.researchgate.net/profile/Kamal-Acharya-15/publications
Visit google scholar profile: https://scholar.google.com/citations?user=9QoTDzIAAAAJ&hl=en

View publication stats